

THE
FAR EASTERN
REVIEW



上海黃浦灘
第四號

遠東
時報

THE CRISIS IN THE PACIFIC
COMMERCE OF THE U.S. AND JAPAN
CRISIS IN THE FAR EAST

Vol. XXXI

MAY, 1935

No. 5

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The Far Eastern Review

ENGINEERING

FINANCE

COMMERCE

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SHANGHAI, MAY, 1935

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The Crisis in the Pacific*

By the Most Hon. the Marquess of Lothian, C.H.

Lord Lothian opened his address by referring to the announcement which appeared in the papers that evening (December 12, 1934), that the Privy Council of Japan had authorized the Japanese Ambassadors in Washington and in London to submit their formal denunciation of the Washington Treaties on December 29, 1934, "thereby fulfilling an expectation which a great many experts formed at least six months ago, that the naval negotiations were only the prelude to the far more formidable act of the denunciation of the Washington Treaties themselves."

* * *

LET me begin by saying a few words about the Washington Treaties. After the War what was generally spoken of as a "war cloud" arose over the Pacific, between Japan and the United States. It was due partly to rivalry as to the future, partly to the refusal of Japan to evacuate Shantung. In 1921, however, there took place the Washington Conference, which dispelled that war cloud and led to a series of treaties which I think most people will agree was the most successful peace settlement made at the end of the War.

The beginning of that settlement was an agreement on the part of Great Britain to substitute a new form of agreement for the Anglo-Japanese Alliance of 1902, which, it will be remembered, had isolated the impending Russo-Japanese conflict and later kept Japan on the side of the Allies during the critical early days of the World War when to most of the world it seemed probable that Germany would win. This agreement to terminate the Anglo-Japanese Alliance was settled at the famous Imperial Conference of 1921, when three things happened.

In the first place, it became clear that under no other conditions than the abandonment of the Anglo-Japanese Alliance would the United States modify the immense naval building program which President Wilson had launched at the end of the War, when no conclusion had been come to about the freedom of the seas; a program which, when completed, would have given to the United States a much bigger navy than the then British navy. The British Government had already prepared drawings for new battleships for the British fleet in order to maintain the ratio with the United States which it thought necessary at that time.

The second preliminary was the intervention of Canada, which took the line that if Great Britain, Australia and New Zealand clung to the Anglo-Japanese Alliance it would inevitably produce bitter hostility on the part of the United States. While there was a clause in the Alliance which automatically eliminated the United States from its purview—the Alliance provided that if either of the two countries, Japan or Great Britain, was at war with more than one Power, the other would come to her assistance—the Canadians held the view that the United States would feel that, so long as the Alliance existed, if a conflict arose between the United States and Japan, it would be inevitable that the British Empire would be expected to side generally with her ally, and, therefore, *pro tanto* be unfriendly to the cause of the United States.

The third element was that the Canadian Government, having made inquiries privately in Washington, suggested, not that the Anglo-Japanese Alliance should be merely abandoned, but that there should be substituted for that bilateral Alliance a collective or quadruple treaty between the major Powers of the Pacific to maintain certain agreed principles. It was as a result of that preliminary discussion at the Imperial Conference of 1921 that, when Lord Balfour reached Washington, not much difficulty was

found in coming to a basic agreement, both with Mr. Hughes, the head of the American delegation, and with the representative of Japan, about the termination of the Anglo-Japanese Alliance and to the principles of the Washington settlement.

The Washington settlement was based on three clear ideas. First, equality of security between the three major naval Powers—the British Empire, Japan and the United States. That equality was to be obtained partly by a naval ratio of 5:5:3—that is, Great Britain 5, United States 5 and Japan 3—and partly by an agreement that none of the islands belonging to any of the parties which lay between the three main strategic bases of the three Powers—the Hawaiian Islands (U.S.), Hongkong (G.B.) and Yokosuka (Japan)—should be fortified. This meant that the naval bases were so far apart that it would be practically impossible for the fleet of any one to attack the main base of any other.

The 5:5:3 ratio did not represent any agreement as to relative status or importance of the three Powers. It represented, in effect, a broad stabilization of the then existing ratios, and the difference between Japan and the two English-speaking Powers was justified by the fact that Great Britain has many other obligations than those in the Pacific—in the North Sea, the Atlantic, North and South, the Mediterranean, and the Indian Ocean—and the United States has two naval fronts, the Atlantic and the Pacific. Japan, on the other hand, has only one front, the Pacific, and had then and has now by far the largest army of any Pacific Power. At any rate, it was accepted at that time that a system of non-fortification of the Pacific islands and naval ratios as laid down would give equality of security to the three major Powers. That was the first political principle underlying the Washington Treaties.

The second principle was the integrity of China and the maintenance of the "open door" within it; and China for this purpose was universally recognized at that time as including Manchuria. That had been an ancient doctrine in the United States, the so-called "open door policy" of Secretary Hay, and it figured in the Anglo-Japanese Alliance itself.

The third was that Far Eastern affairs, and especially the declaration of policy in regard to China, were recognized to be the collective concern of the nine Pacific Powers—the United States, Japan, Great Britain, Canada, Australia, New Zealand, France, Holland, Portugal. Russia was not represented at the Conference.

The war cloud disappeared immediately after the signature of the Washington Treaties, for under an arrangement to which the other Powers were not parties, Japan by a voluntary agreement with China withdrew from Shantung and came to a settlement in her relations with China based upon the principles of those Treaties. The Washington system has now been in existence, I think with great success, except for the Manchuria incident, for thirteen years.

The origin of the naval negotiations which have been taking place in London is, as far as I am aware, somewhat obscure. It has always been my view that negotiations about disarmament are bound to be futile unless there is first an agreement about policy. Armaments are the instrument whereby national policy

*Address given at Chatham House on December 12, 1934, and published in *International Affairs*.

is made effective, for defence or whatever the purpose is—the instrument upon which nations rely. Unless the nations can agree about policy, experience shows that they fail to agree about armaments, and it has long been my view that you will never get a European disarmament agreement unless you first get a political settlement in Europe. None the less these naval negotiations seem to have been begun without any prior inquiry as to whether the parties were or were not still content with the three basic principles upon which the original Washington naval agreement rested. The London Naval Treaty of 1930 only extended the Washington Treaty to cover cruisers and destroyers, more or less on the same basis as capital ships.

Broadly speaking, the proposal put forward by Japan at these negotiations seems to have been a reduction in the level of armaments agreed at Washington to a common "upper ceiling" as it was called, which "ceiling" was to be about the level of the present Japanese navy. This was, in fact, a proposal that the United States and Great Britain should reduce their navies to the present Japanese level, while Japan retained her existing navy. That demand has been rejected both by the United States and ourselves for a number of reasons.

The American reasons were set forth by Mr. Norman Davies in a statement which he made on December 6 last. This is the key sentence:

"Is the equilibrium that was established by the system worked out by the Washington Treaties to be continued or is it to be upset? The American Government stands for continuance. The only alternative that has so far been suggested is that of a new naval agreement based on the principle of equality in naval armaments, a principle which if adopted and applied would not give equality of security."

The American Government has taken the view that the 5:5:3 ratio plus non-fortification was fairly devised to give equality of security to the three naval Powers, in the circumstances in which they were each placed, and that the events in Manchukuo in 1931-32 show that it did give security so far as Japan was concerned, especially as Japan already has the best army in Asia. It certainly did not give security to China. Therefore the United States will not agree to equality of naval armaments; this attitude being strengthened by the fact that, as previously mentioned, she has to maintain part of her navy in service in the Atlantic, as Japan has not.

Great Britain has taken very much the same view. She is not willing to agree to naval equality, as she has to maintain by far the larger part of her fleet in the North Sea and the Mediterranean. To do so would be not only to grant absolute supremacy to Japan in the Pacific, but to destroy her own security there.

Agreement having proved to be impossible on a purely naval basis, either by modification of the ratio on the lines suggested by Japan or by certain counter-proposals put forward by Great Britain, the denunciation of the Washington Treaties on the part of Japan became a certainty. Why is Japan denouncing the Treaties? I believe it is true to say that the moderate element in Japan, which was in power at the time of the Washington Treaties, was satisfied with the Treaties. They took the view that the future of Japan depended on her maintaining harmonious relations with the United States and Great Britain so long as they gave her equality of status in the Pacific. The Washington Treaties gave her complete security in her own waters, gave her a preponderant position in the Far East so long as she respected the integrity of China and the "open door," and made her an equal arbiter with the other two Powers in the larger issues of Pacific policy. The fact that Japan was able to complete the Manchukuo adventure without interference is proof of the exceptionally favorable position in which she was left by the Washington Treaties. The moderate elements in Japan have therefore wanted to maintain them, possibly with some minor modifications. On the other hand, they are convinced that if Japan quarrels with the United States and Great Britain tragedy and disaster must inevitably follow.

The military party has taken a different view, and that party, since September, 1931, has been in the ascendant in Japan. Its argument, as far as I can understand it, is this. Japan as an island with from sixty to seventy million inhabitants can only fulfil her destiny by developing the raw materials of Eastern Asia, manufacturing them in the factories of Japan and selling them back again in privileged and protected markets in Eastern Asia. It is the duty of Japan to lead Asia. If she is to fulfil her economic

policy, still more if she is going to impose her ideas of civilization on the Far East, she is inevitably confronted with a long period of struggle both with Russia and with China, the outcome of which nobody can foresee. The objection, from the extremist Japanese point of view, to the Washington Treaties is that they give to Great Britain and the United States the legal right, under the Nine-Power collective system, to maintain the "open door" and the integrity of China, and also the physical power, if they chose to combine, to intervene effectively in Japan's plans if she endeavored to absorb China or became engaged in a war with Russia.

The view of the militarist party about Manchuria, so far as I can understand it, and it is typical of militarist parties everywhere, was this. There existed a situation in Manchuria which was becoming intolerable quite apart from Japan's larger ambitions. Manchuria was governed by Chang Tso lin and later by his son—a government of no great power or great ability, at first independent of Nanking, latterly associated with it: Japan, on the other hand, had definite rights in Manchuria under earlier treaties, the most important of which were the concessions to the South Manchuria Railway and the right to maintain a police force along that railway. In other words, there were two sovereignties trying to operate in a single State, and history shows that sooner or later one sovereignty invariably has to eat up the other. I think that the Lytton Commission agreed that the situation was intolerable and had to be modified. The military party said: "We shall never be able to modify it in the direction that we want it modified by peaceful means. The process of conference is so difficult that it is probably impossible to change the *status quo* by peaceful means at all. There is only one way of solving the problem, and that is to bring force to bear." Many people are saying the same thing in Europe to-day. They say that in so far as there are evils in the Versailles settlement it will be very difficult to get them remedied by agreement, and that sooner or later they will have to be remedied by force, not necessarily by war, but by power diplomacy. The military party in Japan decided after making inquiries in 1931 in Washington, in London, in Paris, in Moscow—private inquiries, not official ones—that if they took the law into their own hands nobody would, in practice, interfere. Nobody was politically ready to interfere, nobody was physically equipped to interfere. Russia was very weak. Great Britain was profoundly pacifist and was preoccupied in Europe. The United States was pacifist, her navy was below strength and her public opinion was largely indifferent. The military party in Japan decided that if they acted they would "get away with it," because nobody would actually take the measures which alone would compel Japan to desist. The event proved that they were right in their diagnosis. They absorbed Manchuria by force and nobody did more than protest.

That act has challenged the whole concept of international relations embodied in the Covenant and the Briand-Kellogg Pact, the concept that international problems must be settled by collective action and not by the violence of one party, and that it is the business of members of the League to keep a lawless aggressor in check. It was a return to the old system of power diplomacy which was legitimate in the view of the world up to the enactment of the Covenant. When a situation arose in which you could not get your way by diplomacy you tried to isolate your opponent, confront him with the choice between war and surrender, because if he found himself isolated and realized that the alternative to surrender was the certainty of disastrous defeat, he would usually, graciously or ungraciously, yield your case. That happened when the Japanese military party tore up the Nine-Power Treaty.

I think the first question involved in the failure of the present negotiations and the denunciation of the Washington Treaties is which of the two schools of opinion I have mentioned—the moderate party and the military party—is going to prevail in Japan. There is no doubt that there is a struggle going on between the forces of moderation and extremism. It is daily becoming more intense. The military party is not as strong as it was. Its expansionist policy has strained the finances of the country to the utmost. It has financed its budget by borrowing, largely for armaments, and its capacity to borrow is rapidly becoming exhausted. The farmers are in a terrible plight owing to the fall in prices. Expansion on the mainland has not created an outlet for Japanese migration. A large number of people—well informed people—have told me that the outcome of the struggle between moderation

and militarism will be largely influenced by the outcome of the London naval negotiations. If the Japanese military party can secure either a more favorable naval treaty or if they can nullify the basic principles of the Washington Treaties and, still more important, if they succeed in fortifying their islands while the United States and Great Britain do not fortify their possessions—the Philippines and Hongkong—they will have established a naval situation in which it will not only be extremely difficult for the United States and Great Britain to intervene in the Far East, but which will put the Japanese in a position where they can menace their opponents if they start to make trouble. A substantial naval base on the islands which Japan has under mandate would constitute a menace to Hawaii and to Australia; a naval base in Formosa or South China would constitute a menace to Singapore. Supposing such a situation were reached where Japan had naval equality and her islands were fortified and the others were not, Japan would have attained that position which Napoleon said it was the object of all wars to achieve—a position from which other people could not menace her and she could menace them. She could repeat on the larger Pacific stage the success for power diplomacy as against the collective system which she won in the smaller theater of Manchuria, and deal another and more fatal blow to the League and Kellogg Pact idea.

Some of my friends tell me that if, as a result of these negotiations, Japan could secure any such position as this, the military party would gain a new lease of power, would immediately begin to absorb China and would be in office for a generation. They tell me also that if they fail, if the result of their denunciation of the Washington Treaties and the naval ratio is that the United States and Great Britain make it clear that they will build to maintain equality of security, and will fortify their islands if Japan fortifies hers; still more if the United States and the British Empire are brought more formally together in defence of the Washington Treaties, and if China and Russia—and Russia is much stronger to-day than she was in 1921—to say nothing of France and Italy, also make clear their intention of standing firmly behind the basic principles of the Washington Treaties so that Japan finds herself isolated and confronted by a combination where she cannot play power-politics—a combination stronger and better equipped and prepared to take action—the policy of the militarist party will have failed, they will be defeated and the moderate party will be returned to power. If this is so, and while I am not expert at all on Far Eastern affairs, this diagnosis is based on information from people who do know, the situation fundamentally is not unlike that which existed in Europe at the beginning of this century. The question then was whether the world was to have peace through internal revolutions or was to settle the issue between militarism and democracy by world war.

The vital question to-day is not that of Anglo-American relations, but whether the signatories of the Washington Treaties are going to stand together for the principles on which they are based—equality of security, the integrity of China and the “open door,” and the collective system for the Pacific. That is the road both to peace and to justice to China. Failure to stand together, if it enables the Japanese military party to fulfil its ambitions, must, sooner or later, lead to war.

Before coming to conclusions I should like to consider for a few moments the detailed position of the main Powers concerned, as it is only by recognizing the difficulties which confront them that we shall see the difficulties which have to be overcome if a sound solution is to be reached.

First of all as to the position of Great Britain. People do not always realize the present weakness of Great Britain in the Far East beyond Singapore. In 1922 there was no German problem in Europe. Germany was still prostrate and Europe was pacified, if not by the League, at any rate by the military ascendancy of France. Japan was a willing participant in the Washington system. The position is quite different to-day. Great Britain is confronted with a very dangerous situation in Europe. There is danger because of the unstable equilibrium in Europe itself. The capacity of Great Britain to act may be of vital importance. Most people in authority feel that it would be a grave danger to Europe if Great Britain were to move a large portion of her fleet out of European waters. Whilst naval action is very slow in its effects, Germany realizes how very formidable is the blockade in the long run. Therefore, from the point of view both of British defence and of strengthening European stability during the critical

years which lie ahead, Great Britain cannot denude these islands of her fleet. She has also to consider the Mediterranean. On the other hand, in the Far East, Japan is now not willing to continue the Washington Treaties. The party in power is militarist; the country is much more powerful than it was when the Anglo-Japanese Alliance was made. Japan to-day is expansionist. In these conditions there are three possible policies for Great Britain. She can build an additional fleet and station it at Singapore. Such a fleet would be able to make itself felt in the Pacific. You can all realize the difficulties of that policy, both financially and from the point of view of disarmament. Or, she can come to a definite understanding with the United States as to the terms on which they will stand together. Alternatively, if she cannot get an agreement with the United States she can try to come to terms with the Power—namely Japan—which is best able to damage her vital interests in the Far East.

There is a section of opinion in Great Britain which thinks that the last is the right solution. My view is that it is both a feeble and a delusive policy. The only condition upon which Japan would guarantee British interests and possessions in the Far East would be a condition which would reduce Great Britain to dependence on Japan. We should have to abandon both China and the collective system in the Pacific and so agree that Japan was the sole effective Power in the Far East, and we should have to undertake to remain neutral in the event of a Japanese quarrel with Russia on the one hand and the United States on the other. I cannot conceive of Japan being willing to guarantee our trade or possessions for any less price, because otherwise she would be giving a guarantee for nothing. Such a policy, too, would, of course, inevitably split the Empire from top to bottom. General Smuts made that quite clear in his remarkable speech at the recent dinner given by the Institute. It would certainly lead to the United States being estranged from Great Britain, retiring to Hawaii and leaving Japan completely dominant on the coast of Asia. Finally, the security of British possessions in the Far East would depend on the duration of time that the military party in Japan decided that it was to their interest to abide by the arrangement. I, therefore, rule out such a solution.

Is it possible to make an arrangement with the United States? If such an arrangement were made, would the United States live up to it? And would we live up to it on our side also? It sounds an easy question to answer, but it is not. It is going to be the core of the issues which will be debated in the world in the next twelve months.

Let me take first of all the United States. The United States is more pacifist to-day than she has been in her history. The American eagle in the old days used to be rather fond of screaming, but since the War its screams have had no belligerent note. The dominant feeling in the United States to-day is that she will be lucky, in the world as it is, if she can keep out of war, that war seems to be approaching in Europe and that it is possible also in the Far East. The rank and file of the American population is inclined to say: “We are not liable to be attacked in our own country; is it not the right policy for us to have a navy which will keep Europe off North and South America and will enable us to maintain a defensive line in the Pacific which will keep us free from menace from Asia also?”

There is another section of United States opinion, a more far-sighted section, which recognizes that in the long run that attitude is fatal both from the point of view of peace for the United States and from the point of view of world peace. It has no illusions about the party now predominant in Japan and its intentions, and it recognizes that the right solution, the solution which has the best promise both for justice and for peace, is that the United States should stand whole-heartedly behind the collective system in the Pacific—not in Europe. Where the President stands I do not know, but he has shown his intention of building up to the 5:3 ratio by producing one program of naval replacement after another in the last year and a half. It is quite certain that the United States will not allow the Washington ratio to disappear.

It is not going to be easy, in my view, to convince the great mass of American opinion that it is in their own interest, if they are challenged by Japan, to stand behind the three basic principles of the Washington Treaties in so definite and decisive a way as to convince the Japanese militarists that they cannot force a split between the United States and the British Empire. What the ordinary American is inclined to say is: “Our actual interests in

the Far East are very small; our trade, for instance, is much less than that of Great Britain; our actual territorial possessions are only the Philippine Islands, which we have contracted to evacuate at the end of ten years if the Filipino people wish to take over their own affairs. Standing for the collective system in the Pacific means, in fact, pulling the chestnuts out of the fire for Great Britain in the Far East. Great Britain and the British Empire will be the real beneficiaries of such a policy."

If this question comes to a head there will be a severe struggle in the United States between the two points of view. The long-distance point of view is represented by a very interesting article contributed by Colonel House to an American paper called *Liberty*, in which he says that the United States must come out of isolation, must take on the major responsibility of defending the collective principle in the Pacific, in view of Great Britain's liabilities elsewhere, as the only way of eventually keeping herself out of war. I think that is a perfectly true diagnosis. But democracies are proverbially slow in understanding the ultimate implications of international affairs, and even more proverbially slow to take action in a crisis, often postponing action until perhaps it is too late.

On the other hand, there seems to be little doubt that the Administration in the United States is to-day inviting Great Britain to co-operate actively with herself in maintaining the basic principles of the Washington system, including the maintenance of the collective system in the Pacific. Mr. Norman Davis, in an authorized statement made on December 6,* said:

"In order that each nation might be warranted in subscribing to qualifications of its sovereign right to maintain such a navy as it saw fit and at the same time feel reasonably insured against aggression, there was concluded a group of agreements, the purpose of which was to remove the causes and the incentive for aggression by establishing a collective system for co-operation among the nations concerned in promoting and maintaining conditions of peace in the Pacific and the Far East. . . .

Is the equilibrium that was established by the system worked out in the Washington Treaties to be continued or is it to be upset?

The American Government stands for continuance."

I think that is the first time that the American Government has mentioned the collective system since 1920. It is a very significant thing that the United States says that she is prepared to stand by it so far as the Pacific is concerned.

Let me now turn to the difficulties of the British position. I do not want to discuss the Manchuokuo incident, but Great Britain was certainly not in the front rank in maintaining the collective system in the Pacific at that time. Mr. Stimson was much more forward in the matter than we were. I have always thought that the mistake of British policy at that time was not the view which it took of Japan's intentions in Manchuria—I think its diagnosis was closer to the realities than that of the United States—but in its rejection of Mr. Stimson's offer to reverse the isolationist decision of 1920 and act with us in support of the collective system in the Pacific. This failure on our part to live up to the spirit and the letter of the Washington Treaties early in 1932 drove the United States back in to isolation. The question to-day is whether Great Britain is going to repeat that mistake and drive the United States back into isolation again.

That is the real issue which will arise out of the naval discussions in London. I do not want to exaggerate. I have not underrated the difficulties of knowing where we are with the United States, owing to its constitution. It is one thing, as we all know, to find out what the President of the United States wants to do, and it is quite another thing to be sure that the United States itself, and still more the Senate, is behind that position. Therefore I do not plead for any undue recklessness. I plead for the view that we should go just as far in supporting the Washington principles as the United States will go—no farther—but that we should not, by hesitation, destroy this opportunity, perhaps the last that will occur for another ten years, of securing the active co-operation of the United States in the collective system in the Pacific.

The difficulties from the British point of view are, I admit, not to be minimized. Supposing that we agree to stand for the Washington principles with the United States, and suppose the Japanese military party, following the ordinary rules of power diplomacy, decide to pick a quarrel with us and not with the United States, and to go for those hostages of ours in the Far East, the

Yangtze trade and Hongkong; what is to happen? If the United States is not in the crisis with us from the start, we shall have nothing else to do but to retire to Singapore. We have no fleet in the Pacific. We can defend Singapore, so I am assured, but we cannot go beyond it. Can we rely upon the United States to stand by the collective system in the Pacific if it is challenged in this way? The best answer is that the United States cannot make the collective system or the Washington principles effective in the Pacific area unless we are with them. The issue is really the same for both of us. Together we can succeed; divided we are each impotent. Yet the difficulties of co-operation are not easy to get rid of. Will the United States stand behind the collective system, or will it be represented to her people, by another "band of death," that to do so is just involving the United States in Great Britain's wars? And will Great Britain also agree to back the collective system and the Washington principles in the Far East even if the United States does so also? Will she agree to take a firm stand against Japan, if necessary, without having anything more substantial to rely on than a declaration by the United States Administration that they intend to stand by the fundamental principles of the Washington system, or will she hesitate and try to keep in with both sides as she has been doing since 1931?

I think that Lord Balfour would have taken the risk. He would have said that the United States, having the same ideals as ourselves and a large population mainly of the same race and with the same institutions as ours, would come in on the right side, late perhaps, but in time. The act of faith which Great Britain has to make is the same as in 1914. By the year 1916 she had made up her mind that she had guessed wrong, but within three months of the end of the year she found that she had been right after all and that the United States was on the side of the Allied cause with all her might and main.

I only want to say two things more. The first is about China. The ultimate solution of this whole problem is the regeneration of China. There is no other ultimate solution. All the difficulties arise from the fact that China is in disorder and that Japan therefore thinks she is in a position to establish a dominant position in China, to secure privileged economic interests there, and eventually make herself overlord of the country.

I am told by a number of friends that the most remarkable and significant thing that is happening in the Far East to-day is the slow, imperceptible recovery of China. It is like an ant-heap in which people suddenly observe that somehow order is beginning to appear in what looks like a completely disordered mass. I am also told that the Japanese, who, as I said before, are becoming very much strained, are also becoming increasingly conscious of the latent strength of China. Therefore, if we are going to solve the Far Eastern problem, perhaps the most important thing is that the Powers of the West, including the United States, should go actively to the support of China in the next few years to assist her to organize herself and strengthen her government, because that is the only solution of the problem which would be final and which does not involve the immense difficulties and dangers which are inevitable so long as China is weak and disorganized.

The second thing I want to say is that I am in no way hostile to Japan. I believe that Japan ought to have, and will always have, a predominant influence in the Far East, if she follows the line of good-will and moderation. But I believe that her own historians will come to see that the denunciation of the Washington Treaties under the dictation of the army and navy—treaties which had eliminated the war cloud from the Pacific, which had stopped competitive building, which gave to Japan not only security but predominance in the Far East with everybody's consent, provided she did not challenge the integrity of China proper—was the most disastrous decision taken since she entered upon the modern era. It imperils all she has gained in fifty years of patient effort, and will, I believe, gain nothing but frustration and failure. For, despite all the difficulties, I am convinced that if it is the policy of Japan to upset the Washington principles, to destroy the integrity of China and upset the equal security created in 1922, not only will the United States and Great Britain be driven to act together in defence of those principles, but China and Russia also, and that the combination will be strong enough to prove to Japan that she can find salvation on the lines of the Washington Treaties and on no others.

*New York Times, December 7, 1934

Commerce of the U.S. and Japan*

By F. R. ELDRIDGE

Following is the text of a recent address delivered by Mr. Eldridge, Chief of the Commercial Intelligence Division of the Bureau of Foreign and Domestic Commerce, before the National Foreign Trade Convention in New York City.

* * *

WE hear a great many discussions about Japan's growing competition, but few of them, it seems to me, take into consideration this fundamental principle. Our exports to Japan exceed our imports from Japan. Last year we sold \$143,434,000 worth of American goods in Japan and bought \$128,421,000. For the first six months of this year we sold \$90,624,000 and bought only \$59,686,000.

This favorable merchandise balance in our trade with Japan is not compensated materially by unfavorable invisibles, such as our tourists' expenditures, or our ocean freight payments to Japan. Japan finds the dollars to pay us for these surplus purchases by selling to other countries, which in turn sell us considerably more than they buy from us. When, therefore, we find Japanese competition difficult it is well for us to remember that were it not for that competition Japan would not be in a position to pay for part of the 1,846,000 bales of raw cotton we sold Japan last cotton year. For the first two months of this cotton year (August and September) our exports of raw cotton to Japan amounted to 239,000 bales. Japan is obtaining the dollars to pay us for this cotton by selling her products to countries which sell us a surplus.

Export of Raw Cotton

The Secretary of Agriculture has estimated that we should export 8,000,000 bales of raw cotton annually in order to avoid serious internal changes in the economic structure of our country. Our exports of raw cotton to Europe are diminishing. What is the significance to us of maintaining and developing the market for our raw cotton in Japan? Is it of greater or less importance to us than the inroads that have been made into our exports of competitive products in Latin America and elsewhere? I shall not endeavor to answer this question, but I should like to present some facts in relation to it for your consideration.

Japan's exports of unbleached, bleached and printed and dyed piece goods to all of South America totaled 40,349,000 square yards for the first five months of 1934 as against 18,489,000 square yards for the first five months of 1933. Her exports to South America for June, 1934, of these classes totaled 16,050,000 square yards, or 56,399,000 square yards for the first six months of 1934.

An examination of all the available import statistics of Latin American countries for the years 1932, 1933 and 1934, indicates a falling off of our percentage of imports in eight out of twelve from 1932 to 1933. The percentage of Japanese gain during that period was by no means as great as the percentage of our loss. It is only within the very recent past that Japanese competition is being seriously felt.

For the first six months of this year the situation is somewhat changed and we show increases on our former gold basis in our exports to all countries of the Far East except the Philippines, Hongkong and Netherlands India, and also increases in our imports from all countries except Japan, British Malaya and Kwantung Leased Territory.

If there is any significance in this trend of our trade relations with the Far East it lies in the fact that Japan is paying for her increased imports from us by her increased sales to these countries, they in turn effecting the transfer by their increased exports to us.

More significant, however, is the indication of the recent trend which indicates that the purchasing power released in these countries by their more economic dealings with Japan for staple products such as piece goods has gone into greater purchases of other things that we can produce, such as motor-cars.

This represents, in effect, the whole sum and substance of the arguments for reciprocity. By a more economic allocation of the world's business among the countries best fitted to produce certain commodities, all nations eventually prosper.

At this point I should like to quote from my article in the *August Current History*. Practically 30 per cent of Japan's exports consists of cotton and silk tissues. Of the remainder not over 20 per cent are raw materials. The balance of 50 per cent consists of a variety of fabricated articles into whose production human labor enters in greater or less degree.

Japanese Labor Organization

How this labor is organized, how the men and women who make the wide variety of things which Japan exports live and work—that is the key to Japan's success as an exporting nation. England has been called a nation of shopkeepers. Japan is a nation of workshops. The great majority of these miscellaneous goods are not made in great factories. Industrially Japan has scarcely emerged from the household stage of industry. The only large factories are the cotton and rayon mills. Practically all the other commodities which Japan exports are turned out in small workshops. There are hundreds of these small workshops in Tokyo and thousands in Osaka. Electric power is cheap and plentiful, supplied by the great turbines harnessed to Japan's torrential mountain-fed rivers. Japan's workers, some highly skilled, are paid less in yen (worth 30 cents) than America's are paid in dollars. Machinery is surprisingly up-to-date, although if examined closely it will prove to be a faithful imitation of Western models whose makers have failed to protect their patent rights in Japan. The buildings in which the goods are manufactured are often nothing more than rough sheds, although there are many exceptions, such as the modern factory buildings of the Tokyo Electric Company, at Kawasaki, in which electric light bulbs are made, and the Shibaura Works in Tokyo, which turns out electric motors.

Many exported products, however, such as pottery, toys, knitted socks, straw braid, jewelry and umbrellas, are practically all farmed out to households in the towns and villages of the interior. An entrepreneur in Osaka or Tokyo will receive an order from one of the large exporters, with branches overseas, buy the raw materials and take them to one or more villages where the headmen undertake the responsibility of seeing that the samples are copied exactly and that the products are ready by a certain date. This does not lend itself to regularity in style, and on large orders foreign buyers still complain of many variations from sample, although the government has established an inspection service to insure standard quality.

Some industries are confined to narrow districts generally because of the fact that the raw materials can be best grown in those particular parts of Japan. This is true of menthol crystals, camphor (all of which comes from Formosa), insecticide flowers and tea. Raw silk, while produced in practically all parts of the main island of Hondo, also has its districts noted for quality, such as Shinshu, where a variety of conditions, including the quality of the mulberry leaves on which the silk worms feed, the favorable weather for breeding silk, the skill of the girl reelers combine to create a standard of excellence by which all other raw silk is measured.

The great majority of the workshops in which Japan's exported goods are made are family-owned. Many of them are partnerships. Few of them are affected by labor troubles, for migratory workers are not common. The workers look upon the owner as the head of an industrial family. If business is slack and workers must be laid off, custom demands that they receive from six months' to a year's pay. Even the larger textile mills adopt this paternal attitude toward their workers.

The reasons for Japanese individual industrial success are, therefore, many and varied—cheap and plentiful power, cheap and relatively efficient labor, adaptability in the use of modern machinery, low overhead in cost of plant and buildings, the use of the household system in many items of export entirely eliminating

*The Japan Advertiser.

factory overhead, effective localization of industry in other items and a general minimum of labor troubles because of the intimate paternalism still possible under small units of production.

Cost of Labor

Of all these factors the cost of labor is the most important. It is due to the relatively simple existence to which the Japanese are accustomed. A Japanese family is able to subsist on a diet of rice and fish, with few vegetables. Soya bean curd furnishes the necessary protein in the diet which American and some European workers find in a much more expensive meat diet. Food comes to the Japanese worker cheaply, because it comes directly from the soil and the sea. Under an economy based upon a meat and milk diet, Japanese wages would be much higher. For about \$12 a month a family of five can rent a house of three or four rooms with a garden in the suburbs of Tokyo or Osaka. The sitting room is converted into bedroom for the whole family simply by spreading thick quilts on the matting-covered straw-stuffed mats. Furniture is conspicuous by its absence. No "flivver" stands before the door. A good silk kimono for dress occasions will last a lifetime. Broadly speaking, the Japanese pay in yen the same prices that we pay in dollars for most of the things they buy, and the *per capita* demand for these things is about half of ours.

It is thus quite meaningless to use the measuring stick of the wage level alone in attempting to analyze Japan's comparative advantage in industrial labor costs. Because a male worker in a textile mill in Japan receives only 58 cents a day, that does not mean that he lives in the same way that a workman on such daily wage would live in the United States or in many industrial countries of Europe. It is what the wages will buy in terms of the accustomed comforts of life in each country that should be considered. A Japanese worker can live just as happily and comfortably as an American workman who receives six times his wage.

It is not only in cost of production that Japan has an advantage over her competitors. Japan has striven to expand her export business with more thoroughness and intensity than has any country, with the possible exception of pre-war Germany. Through such novel devices as her "floating marts" small individual exporters have an opportunity of penetrating beyond the primary marketing centers in the Dutch East Indies, the Near East and South Africa. While the large merchant houses concentrate on distribution through branch organizations in China, the United States, Australia and India, where their selling costs are reduced by their utilization of the same overhead for the buying of raw materials as well as the selling of manufactured goods, the small merchants use such facilities as permanent trade exhibits in places not so effectively covered. Japanese trade delegations travel over South America gathering samples of what the markets demand and booking orders.

Japanese Factories Busy

In this manner Japanese factories and workshops have kept busy, and the increased production on lowered overhead cost per unit has given Japan an additional advantage. Last year, with 8,000,000 spindles, Japan equaled England's export of 2,000,000,000 yards of cotton goods, although England has 50,000,000 spindles. Japan's spindles were working full time, while only one-sixth of England's spindles were busy. With population constantly pressing upon food supply in Japan, competition among individuals remains keen. Japan's economy is frankly capitalistic. It is not a surplus economy such as ours. It is a scarcity economy, and hard work is the rule and not the exception. Japan has no income from huge overseas investments such as enables England to support millions on the dole.

During the worst phase of the depression Japan was aided in her export drive by the reimposition of the embargo on gold exports in November, 1931, shortly after Great Britain went off gold. The embargo on gold had been lifted in 1929 to enforce deflation in the Japanese price level. When it was reimposed the exchange value of the yen declined and the domestic price level rose. The net effect was to lower the external commodity price level in terms of American money from 116 (1913—100) in November, 1931, to 64.5 in February, 1933. During the same period the internal American price level fell from 85.5 to 67.7. On the same basis the Japanese export commodity price level was

91.8 in April, 1933 (1913—100) as measured in sterling, as against an internal British commodity price level of 87.0. It was not by "exchange dumping" that Japan's exports were favored by the fact that raw materials bought with a high yen in 1931 were being sold with a low yen as fabricated materials during 1932 and 1933.

The result of Japan's invasion of the erstwhile trade preserves of Great Britain, not only within the British Empire but also in Latin America, in competition with domestic industries there, in the Dutch East Indies, in competition with home industries in Holland, and also within the trade preserves of Italy and France has been to raise barriers against the importation of the goods in which she specializes. The effect has been to emphasize the tendency toward economic nationalism. Japan's only weapon is her heavy purchases of raw materials, such as raw cotton from India, wool from South Africa and Australia, wood pulp and lumber from Canada, rubber, raw sugar and mineral oils from the Dutch East Indies, hides and skins from Argentina, nitrates from Chile and a long list of other imports. The total of these imports exceeded Japan's exports in January, 1934, by 16,544,000 yen, and they were bought very largely in the same countries to which Japan sells and by the same Japanese organizations in each case. For this reason, a large and growing body of Japanese industrial and commercial opinion is coming to favor a freer and more unrestricted international trade.

Japan in World Markets

Should we adopt a less critical attitude toward Japan's ability to compete in world markets and view the whole matter broadly? Can we hope to serve the whole world efficiently in respect to the production of all commodities? Japan seems peculiarly fitted to produce the cheaper grades of textiles. If she does so and is enabled to maintain her population respectably at home, should we oppose her? She buys our raw cotton and maintains our economic equilibrium in so doing. She sells more cheaply to many countries which are thereby obviously benefitted. She releases purchasing power which these countries eventually spend for the things which we can make to advantage.

Can we afford to view Japanese trade, by and large, as complementary to our own? Japan is our third largest customer. Its industrial activity accounts for a large share of the prosperity of our cotton farmers. On the other hand, Japan is undoubtedly making serious inroads into certain branches of our Latin American or Far Eastern trade. As I stated at the outset Secretary Roper has said: " * * * No nation * * * can expect to sell goods unless it buys goods in return." Is the converse of this principle equally true, namely, that no nation can be expected to buy goods unless it sells goods in return?

Dairen Aerodrome Improvements

The construction of a new macadam flight way extending over 600 meters forms one of the most noteworthy improvements of the Dairen aerodrome to be undertaken this year according to the plan prepared by the Communications Bureau of the Kwantung Government.

Mr. Kondo, superintendent of the Finance Department of the Communications Bureau states that some of the important improvements included in the present appropriation are the construction of a macadam flight way of 682 meters long and 40 meters wide at a cost of Y.49,500 ultimately extending it to 900 meters long and 60 meters wide at a total expenditure of Y.200,000 on a three-year plan, and the equipment of flashlights for night service at a cost of Y.37,000.

Other additions included in the present plan are the equipment of aeroplane inspection apparati and the establishment of six large and small signal posts between Dairen and Antung.

It is also reported that the year's appropriation asks for the establishment of a new aeronautic wireless station at a cost of Y.87,000.

Although the Dairen aerodrome is one of the most important terminals in the air route between Japan and Manchuria, it has been left untouched for the past several years without any improvements according to the officials of the aerodrome. The present improvement plan is said to be first of its kind to be undertaken.

Crisis in the Far East

By O. M. GREEN, in the "Asiatic Review"

THE recent conversations in Nanking and Tokyo on what is politely called "the settlement of outstanding questions" have once more brought the affairs of the Far East prominently before the world. Speculation is rife as to the exact nature of the discussions. By one account Japan is plotting to detach China from the West and get her completely under her own control, as she has got Manchuria. By others she seeks only peace, amity and the welfare of her huge, still rather dishevelled, neighbor. As one looks into the state of both countries, it is conjectural that either of these explanations might prove the correct one, according to the events of the next few weeks. One thing is certain—namely, that never since Geneva's failure in the Manchurian contest was sealed by Japan's resignation from the League has the Far East called so urgently for close study and the wisest diplomacy as it does to-day.

Briefly, the outstanding features of the situation are the breakdown of the naval discussions between Great Britain, America and Japan, and the latter's denunciation of the Washington Treaty; China's haunting fear of Japan and the loss of her seat on the League Council; and in the background scarcely noticed as yet by the world at large, but none the less charged with grave danger for the peace of Asia, the nationalist awakening of the Mongols.

Reduced to a common factor, these jarring elements mean that a new world is growing up out of a very old one, imbued with a new spirit and already possessing an uncomfortable mastery over the modes and mechanisms in which the West was formerly its condescending instructor. Here is a situation from which the West cannot afford to stand aloof, and at the same time it will need all the tact it can command—a quality hitherto conspicuously absent in its dealings with the Far East—if it is not to drive this new spirit into open antagonism. Already the Far East is in a position to confer rather than ask for favors.

In the *Asiatic Review* of last October I described the progress that China has made in the past three years—thousands of miles of new roads, railways repaired and under construction, public works of several kinds, above all the absence of any major civil war and the growth of better feeling between Nanking and the provinces. Since that article was written, General Chiang Kai-shek's long, undaunted campaign against the Communists has, with the aid of Canton (a particularly good omen), been crowned with success in the overthrow of the Red State in South Kiangsi. The Communist menace is still far from being exterminated, as will be shown. But the material and moral value of the achievement is none the less very great.

Another notable event is to be recorded. It may be remembered that in May, 1932, Nanking publicly abjured the policy of "unification by force," declaring that it would fight no more civil wars, but concentrate upon the resuscitation of its own sphere of influence, leaving the more distant provinces to manage theirs. So effectually has this policy been pursued that we now find Nanking speaking of, and thinking for, "the Nine Provinces" almost as if they were a separate state (there are, of course, eighteen provinces in China), and extensive telegraphic and telephone equipment is now being completed in England for "the Nine Provinces." Nanking, however, remains the Central Government, speaking for China in international affairs; and if the different parts of the country are to rub along without too much jangling, some working arrangement is necessary in respect of finance, appointment of officials, etc. Hence the importance of the scheme adopted at the Kuomintang conference in Nanking last December, which defines the respective powers and rights of Central and Provincial Governments in these matters, with satisfaction for the *amour propre* of both.

It may be that this agreement marks the first real advance towards a Federated States of China, which many believe must be the ultimate solution of her problems of government. At present she has no Constitution, and there is no word exactly to describe what she is. A committee was appointed last year to draft a Constitution, but one may well pray that its labors will be long

and unhurried. Such attempts, of which there have been several in the past, have always ended in fresh discord. The first requisite is to restore order, cut down taxes, solidify the better feeling among the provinces. With these desiderata accomplished, constitutional questions would solve themselves.

While recognizing the bright lights in the Chinese picture, we must assuredly not overlook the shadows. No effective approach can be made to the question of the Far East unless we face the fact that China is still in a very half-and-half stage, immeasurably advanced from what she was five or six years ago, yet continually weighed down by enormous burdens. Whatever Japan's ideas may be regarding China, the foundation of her argument has always been that she cannot yet stand alone, as the Chinese themselves admit; and now the question is whether China shall lean to the West or to the East or whether, more happily, the two might combine in helping her up the hill.

Some of China's misfortunes are of her own making, some beyond her control. Among the latter the most conspicuous is the American Silver Purchase Act, which, by driving up the price of silver from about 1s. 1d. per ounce two years ago to nearly 2s. 3d. at the moment of writing, has not only hit China's exports, but has caused an outflow of silver from her coffers which has most seriously damaged her trade all round. A hurried attempt on China's part to keep down the value of the dollar, and thus lower the cost abroad of her exports, by means of a prohibitive export tax on silver, has only aggravated the evil by creating an artificial difference between the internal and the world value of her currency, which has resulted in millions of ounces weekly being smuggled abroad. No more disastrous New Year, the traditional Chinese settlement day, can be recalled than that of last February, with money almost unobtainable, cargo that could not be taken up, and bankruptcies galore. An Advisory Committee on Currency has been appointed and measures adopted to tempt silver back to China. But it is too soon to say how these will succeed, and the financial situation remains very serious.

High silver, however, is not the only cause of declining exports, and the balance of trade is not to be achieved by manipulating currency. The heavy duties levied upon all exports is partly, perhaps, a relic of the days when China had no interest in foreign trade, but much more of the deep-rooted official conviction that merchants exist merely to provide their betters with a comfortable living. At any rate, the export duties are a suicidal anomaly which ought to be swept away. Combined with the crushing internal taxation, they constitute a drag on China's progress for which neither world depression nor the expedients of foreign politicians can be blamed. By all tradition, and in simple fact, the peasantry are the backbone of China. Nanking certainly is well aware of it; but all her efforts and admonitions have not yet succeeded in relieving the farmer of the swarms of harpies who prey upon him in every province.

The Communists, too, it is to be feared, will remain an obstacle to all ordered government for some time yet. Driven from their former stronghold in Kiangsi, they have been harrying Central and Southern China in scattered bands most difficult to round up, thus perpetuating the need of the military operations, which the peasant dreads as much as he does the outlaws, and draining national finances. The bright side of the picture here is the active co-operation of provincial governments with Nanking against the common foe. But there is a real danger that the Reds may set up a new state in north-eastern Szechuen—the worst-governed, most distracted province in all China—where it would not be difficult for Russian agents, who now begin to permeate the north-western province of Sinkiang in increasing numbers, to join hands with them. It may be remembered that Mr. Hirota, the Japanese Foreign Minister, in his speech in the Diet on January 22, pointedly alluded to "the Sovietization of Sinkiang." There is, of course, nothing that Japan so much fears as Communist propaganda, and Mr. Hirota's remark is particularly to be remembered in connection with the present discussion between Tokyo and Nanking.

It is possible, however, to believe that China would find a way through even these troubles if her mind were not distracted by other anxieties. The Communists are not very different for practical purposes from the Taipings, who ravaged China for fourteen years in the middle of last century, since only a nucleus of them are inspired by the real Russian ideology, and it is impossible to believe that a nation with the traditions and instincts of the Chinese could be converted to Communism. This is in no sense to underrate the Red menace, but only to put it in its right proportions. The downfall of every dynasty has been followed by decades, even centuries, of disorganization. And in the present instance the Government has the assistance of the League of Nations' advisers, and of the British Boxer Indemnity millions, in carrying out its schemes of economic improvement which cannot fail in the long run to result in popular betterment. Moreover, China watches what goes on abroad as never before, and is keenly alive to foreign reactions; and it is not too much to say that her leaders are inspired by a real desire to "make good."

In studying the relations of China and Japan, one must try to see each country as the other sees it. Both are adepts in pretty speeches, which, whomever else they may confuse, do not in the least deceive the other. China's suspicions of Japan go much deeper than the loss of Manchuria can explain. China has been defeated by and lost territory to foreign nations again and again in the past hundred years; and if such misfortunes have not increased her affection for her conquerors, they have not left that abiding mistrust and hatred for them which she feels for Japan. As regards Manchuokuo, "time, the great healer," has to some extent been at work. Through running of passenger and mail trains between China and Manchuokuo has been restored, collection of Customs and guardianship of the passes in the Great Wall have been compromised. But China is as far from recognizing the new State as ever, and it seems not too much to say that any Chinese Government which recognized Manchuokuo would bring on a civil war at once.

The truth is that Manchuokuo is less important to the Chinese as a fact in itself than as an emblem. Rightly or wrongly, they are convinced that the Japanese have always intrigued to keep China in a state of turmoil, and the seizure of Manchuokuo was for them but a stage in the accomplishment of their neighbor's much vaster designs on their own independence. This conviction is intensified by all the events of the past two years: by Japan's withdrawal from the League of Nations; by that ominous, vaguely defined, but to the Chinese perfectly comprehensible declaration, a year ago, of a Monroe doctrine for China; by the uncompromising Japanese temper during the naval conversations in London; by Japan's denunciation of the Washington Treaty. All this, for the Chinese, is irrefutable proof of Japan's determination to drive out Western influence from Eastern Asia and replace it by her own hegemony. The famous Tanaka memorial is, for such Westerners as have studied it, a concoction about as much worth consideration as Mother Shipton's prophecies. For the Chinese it is a perfectly genuine definition of policy, confirmed by all recent events.

From Japan's point of view, one dominant factor is the pernicious result, as it seems to her, of Western influence in all the Far East. As Lord Lytton pointed out in his report on Manchuria, Japan is necessarily and poignantly affected by the internal condition of China; and the sight of the humiliating British surrender of Hankow to the Communists in 1927 and tame acceptance of the Nanking outrage—in the guise of conciliation, about as useful as to offer biscuits to a mad dog—made a deep and unfavorable impression at Tokyo. For the Japanese, as their newspapers plainly said throughout 1931, Great Britain and America were directly responsible for the arrogant Kuomintang temper which led to the dispute over Manchuria; and all through Japan's communications with Geneva, Western misunderstanding of the true facts of the Far East was repeatedly emphasized.

Equally, it is to be observed, are Western influences mistrusted in Japan itself by her chief ruling class. Jazz, the cinema, the affectations of the "moga" (modern girl), disaffection in the student class, industrialism and the schemings of the *narikin*, or capitalists, the futile wranglings in the Diet and its failure to give effective help to the bankrupt peasantry were clear indications to the old Samurai class of Army and Navy that the traditional spirit of Japan, corrupted by effeminate poisons from overseas, was dying. In *The Times* of February 15 last, its able correspondent in Tokyo wrote:

"The Japanese Government's policy in the past three years can only be understood when it is realized that the foreign crisis coincided with a domestic crisis. As the Manchurian campaign developed alarming movements were discovered at home. A Cabinet Minister and a prominent capitalist were assassinated by country youths, the instruments of mysterious patriotic organizations working for what they called a second restoration. This was to set up an ideal State of farmers and soldiers from which the capitalist and his 'docile clerk,' the politician, had been eliminated. Those patriotic fanatics had made converts in the Army.....Whispers were heard of a plot by subalterns to conduct a Pride's Purge of the Diet with bombs.....Concessions had to be made and the situation at home was the explanation of the unbending attitude at Geneva. Without the League to play the part of Jonah the ship of State might have been wrecked.....Japan's policy is still governed by what may be called the General Staff mind."

To that mind the sight of China relying more and more upon Western assistance, engaging tribes of advisers from the League of Nations and with their help achieving a conspicuous measure of economic development, would naturally be displeasing. The tendency must be increasingly to draw China from Japan, if not to set her in open antagonism; and it seems more than mere coincidence that the declaration of the Monroe doctrine for China followed closely upon reports of a big Chinese loan in America, and came just before the presentation of Dr. Rajchmann's report to Geneva on what its lieutenants had been doing in China.

That the nationalist agitation in Mongolia, combined with the now formidable strength of the Russian army, particularly in aeroplanes, in the Amur and Maritime provinces (that is, all along the north and east of Manchuokuo) is giving Japan much anxiety, there can be no doubt. The danger of a direct conflict between Japan and Russia has very greatly decreased since 1933; the sale of the Chinese Eastern Railway to Japan, or nominally to Manchuokuo, for roughly £10,000,000 has helped to clear the air; if the Russian forces are strong, the strategic roads and railways which Japan has thrown out, with almost incredible speed, to the Manchurian borders are a retort on her part by no means to be ignored: neither side has anything to gain by fighting the other, as both are well aware. The occasional sword-rattling at Moscow is for internal edification. Japan at least is not disturbed by it. But as events appear to be moving in Mongolia, the danger of Japan and Russia being drawn into a clash between their respective *protégés* cannot be overlooked. This undoubtedly is the true significance of the Japanese attack on Chinese advance forces in Chahar last January, and of the speed with which Japanese troops were hurled against the raiders from Outer Mongolia at Boir Nor. The real aim was, not the Chinese, but the security of Inner Mongolia; and although the usual assertions have been made by Tokyo that, the Chahar-Jehol frontier having been rectified, Japanese troops will advance no further, no one would be surprised if the generals in Manchuokuo presently found that "military necessity" compelled them to occupy all the provinces of Inner Mongolia along the Great Wall, Chahar, Suiyuan and Ninghsia.

It must be remembered that the Mongols never acknowledged any allegiance to China as such. Their loyalty was always to the Manchus, on whom indeed they always looked, with a good deal of historical justification, as allies rather than masters. When the Manchu emperors fell in 1912, the Mongols declared their independence. Inner Mongolia was not strong enough to stand against the Chinese, who reconquered it. But Outer Mongolia, separated from Inner by the Gobi Desert, was beyond the Chinese reach, and, after various vicissitudes, passed entirely under Soviet Russian influence. The People's Republic of Mongolia is not actually a part of the U.S.S.R., but for practical purposes the result is the same. It is only fair to add (and an important part of the story) that the Russians have treated their *protégé* very well, and the Young Mongols look entirely to them with admiration and gratitude.

Contrariwise, it has to be said that the Chinese treated the Inner Mongols very badly, ousting them from their grazing lands, which were given to Chinese colonists, and seeking continually to obliterate Mongol individuality and "Sinaize" their race. Many sporadic revolts have occurred, always to end in failure. But with Manchuokuo's declaration of independence and the restoration of a Manchu emperor, new hopes have stirred the Mongol princes to activity. They are the more drawn towards Manchuokuo

because the Japanese, quickly realizing the importance of the Mongol community in Manchuria (which numbers about half the entire Mongol population), have secured to it its own province, known as Hsingan, from the mountains which it adjoins, wherein the Mongols are free to live their traditional life and manage their own affairs with but the slightest visible assistance from a few Japanese officials.

It is easily imagined how all recent events in the Far East, together with the universal slogan of "self-determination," have awakened thoughts in all the Mongols of reviving their ancient independence and culture. But they realize that any such attempt must commence with a movement towards the protection either of Russia or Japan. And there's the rub. To link themselves with Manchuokuo and its emperor, as past history would enjoin, means the sacrifice of all the Young Mongol ideology. To follow the lead of the People's Republic means that the princes of Inner Mongolia would lose all their ancient privileges and ascendancy. The dispute is already so sharp that it may not impossibly lead to civil war from which it would be very difficult, to say the least, for Japan and Russia to stand aside. In such an eventuality it needs no saying that Japan would desire to have the differences between herself and China so adjusted that the latter would have no excuse—may it even be suggested, no ability?—to come to Russia's help.

One further consideration must be mentioned. It is inevitable that, when the Naval Conference between Great Britain, America and Japan takes place, if not before, politics of the Pacific will be included in the discussions. The two questions were regarded as inseparable at Washington, and they are not less closely connected than in 1922. But many people affirm that the conference on political issues will take place very much sooner, in fact, it is believed, in the coming summer, and it is suggested that Japan is particularly anxious to have her differences with China disposed of before the conference meets, for reasons too obvious to need stating.

Such is the background of events and emotions leading to the conversations which began in Nanking late in January, and have more recently been continued in Tokyo between the Japanese Foreign Minister and the learned Chinese jurist, Dr. Wang Chung-hui, acting apparently as a sort of unofficial agent. Circumstantial reports have been published that Japan has invited China to send away her German military advisers and take Japanese instead, together with several hundred Japanese non-commissioned officers to be used in training the Chinese army; also that the League of Nations advisers be dismissed and their work be undertaken by Japanese; also that China must once and for all put a stop to anti-Japanese boycotts and propaganda. In return Japan would find money to help China through her silver troubles and would assist her in crushing the Communists.

These details are quoted to indicate the general trend of thought and rumor in the Far East. Actually it appears probable that no definite proposals have been put forward at the moment of writing. One cannot but think that Japan would reflect very carefully before suggesting such a bargain as that described, the effect of which would plainly make her the dominating power in China.

The outlook is complicated by the existence of two parties in China. Ever since the beginning of the Manchurian crisis General Chiang Kai-shek has been accused by his opponents of being pro-Japanese. In fact, no Chinese is that. But General Chiang is above all things a realist: he has repeatedly said that China can never face foreign adversaries until she has conquered her internal difficulties; and it is quite likely that he believes that China must come to terms with Japan because she cannot help herself. Many Chinese do hold that view. China's failure to be re-elected to a seat on the Council of the League of Nations last September was a severe blow to the men in Nanking who preach co-operation with the League as the pivot of Chinese policy. Nothing could be more calculated to create the impression that Europe was indifferent to the Far East and to drive China into Japan's arms.

The extremely conciliatory attitude of Mr. Hirota is another argument for those Chinese who advocate agreement with Japan. His speech in the Diet on January 22, when referring to China, breathed nothing but reasonableness and goodwill. More recently he has declared, also in the Diet, that "it is more important at present to convince Russia and China that Japan's policy is not aggressive than to discuss navies with the United States" (*Times*, March 1, cable from Tokyo). It would appear that, for the time being at any rate, diplomacy has got the upper hand of the military

in Tokyo. And undoubtedly many Japanese are seriously alarmed at the enormous figure of the national budget, a total of Y.2,100,644,938, of which no less than Y.1,021,470,000 goes to the army and navy. An agreement with China would certainly be of great value to Japan.

Withal one cannot get away from that suspicion of Japanese motives which clouds all the Chinese outlook. Thus the *Ta Tung Pao*, a leading Chinese paper, commenting in its issue of January 26 on supposed offers by Japan of a particularly conciliatory nature, says:

"The very fact that these proposals are so reassuring leads us, after mature consideration, to suspect hidden traps and pitfalls. . . . When a country is ruled by its army, and allows the army to present it with *faits accomplis* in a relatively weaker country, or harbors the thought of making use of its might to coerce this country into a non-coercion and non-aggression pact, it savors of bringing peace in one hand and a sword in the other."

Et dona ferentes: these are the thoughts of the overwhelming mass of Chinese. And the same issue of *The Times* just quoted contains a message from its Hongkong correspondent that opposition to Nanking's "pro-Japanese policy" is rising in Canton, and that the veteran Kuomintang leader, Mr. Hu Han-min—still a power in the land in spite of his retirement in Hongkong—has "strongly denounced Nanking's policy as tantamount to making China a Japanese protectorate and ruining China."

In plain fact, it seems impossible for Tokyo and Nanking to come to terms in any manner by themselves without exciting an outcry throughout China that Japan has used force to gratify her ambitions. The more innocent the published terms may appear, the more it will be declared that there are secret and malignant clauses. And it must frankly be added that any number of people abroad will say the same thing. The outcome may very easily be renewed civil war in China and, in other countries, renewed abuse of Japan, which can have no other effect than to infuriate the whole Japanese people, enable the least restrained elements to seize power, and do an infinity of harm to China and all who have dealings with her.

Surely there is not only room now, but an urgent call for tactful and friendly intervention by some outside agency. The word may have a suspicious sound, but the intention would be above reproach. In the case of Manchuria, Japan returned an obstinate *non possumus* to all Geneva's suggestions, partly because she felt that her position was misunderstood, partly because she could see no other way of securing her vital interests. Neither of these difficulties need arise at the present juncture. What Japan needs in China is cessation of propaganda against herself, trade, raw materials. There is not the slightest doubt that China would readily give her all these if she could be relieved of that fear of ulterior designs on Japan's side. Furthermore, there is ample room in China's spacious markets for the customers of Japan and all nations without detriment to each other. No one could reasonably deny Japan's predominant position in the Far East, while the imperious necessities of her huge and ever-increasing population are evident to all. But Tokyo can hardly be blind to the misgivings that exist, both in China and other countries, as to the means by which she seeks to satisfy those necessities, and the extent to which the interests of others might be affected.

And no Power appears better qualified than Great Britain to play the part of mediator. It has been a matter of deep regret to the Chinese, we may well believe, hardly less than to all who know the Far East (not only British), to see how in recent years Great Britain's policy has declined into a mere waiting on events, a hand-to-mouth staving off of difficulties as they arose, an acquiescence in anyone taking the lead so long, it seemed, as she was not bothered. Yet it is the fact that British interests in China still vastly exceed those of any other nation, not even excepting Japan's. She has an intimate acquaintance with China and an unrivalled knowledge of how to approach her, born of two centuries of intimate association. Her unsurpassed Consular Service in China supplies her with an understanding of Chinese needs and susceptibilities which might be turned to the greatest use. She has friends in China and in Japan, and, in diplomacy, the greatest advantage of all, that her word is believed. To convince the Chinese that Japan has no ulterior aims on her freedom; to convince the Japanese that no one seeks to deprive her of the advantages in Far Eastern markets that she justly desires—surely that is a worthy task and well within Great Britain's capability.

An Appeal from Japan

A strong appeal to their fellow countrymen in the United States in the interests of better relations with Japan has recently been drawn up and forwarded to the United States for wide dissemination through various Christian agencies by some 217 American missionaries resident in Japan. The appeal, which is dated Tokyo, April 20, has been issued from Room 62 Nishi-Kanda 1-chome, Kanda, Tokyo. The leaflet is entitled "Some Missionaries in Japan to Their Fellow Christians in the United States." It is in full as follows:

* * *

As Americans living in Japan we find ourselves in a position of peculiar privilege. To the rich heritage of our own citizenship, there is added the wealth of life and friendship with another nation. Our experience has deepened our appreciation of both peoples and has convinced us that priceless benefits will continue to flow naturally from growing intimacy and co-operation between them. For the historical friendship between Japan and the United States is not a mere phrase; it is a fact which rests upon deep sentiment, mutually advantageous commercial interests, and fortunate geographical positions. This relationship has the additional advantage of being enlivened by differing but complementary cultures. Obviously only a structure of peace should rest upon such a foundation.

In saying this we would not ignore differences in point of view on some vital issues. Such differences are inevitable between strong and aspiring nations but they should be made stepping stones to mutual respect and co-operation through the workings of enlightened statesmanship and the diplomacy of peace. We rely thus not only upon the friendly relationships between our two nations in the past but also upon the solemn agreements which both, together with other civilized nations of the world, have underwritten in the Pact of Paris and other covenants.

Peace Endangered

However, in the presence of forces which if unchecked, may easily endanger this long record of unbroken peace, we would urge our friends in the United States to redouble their efforts to understand the problems and difficulties confronting the Oriental peoples, or remove all sources of friction and misunderstanding for which our nation may be responsible, and particularly to cultivate attitudes that will spurn any suggestion of seeking solutions of our problems by means other than the employment of peaceful diplomacy. We plead for the will to peace.

With a solemn sense of our responsibility as Christian Americans in Japan, and in the light of our intimate knowledge of the Japanese people, we declare our conviction that the cause of peace and mutual welfare will be served if our fellow Ameri-

can citizen resolutely and conscientiously consider the following proposal:

(1) To study with care the laws proposed in our legislative assemblies, or already on the statute books, that bear upon our relations with foreign countries, and more particularly to remove the aspects of our Immigration Act which offend the self-respect of Oriental peoples;

(2) To condemn the subversive propaganda against foreign countries frequently appearing in certain of our newspapers;

(3) To bring to bear the force of Christian principles upon the foreign policies of our government;

(4) To support our government in every effort to avoid giving offense to friendly nations by such incidents as indiscreet declarations on the part of public officials, naval maneuvers on the borders of friendly powers, and other provocative gestures of force;

(5) To encourage our government to take the lead in disarmament proposals which, while protecting legitimate national interests, shall eventuate in reduction of armaments to police status;

(6) To cherish the faith that peace can be won and maintained wherever men of good will unite in sacrificial and intelligent co-operation, and to encourage the roundtable method of solving the complex but by no means insoluble problems now confronting the nations in East Asia;

(7) To re-enforce our government in every possible way in a policy of co-operation with other nations through the International Labor Office, the World Court, and all other effective agencies for world regeneration. We believe that the entry of United States into the League of Nations would greatly contribute to the maintenance of peace in East Asia, removing a serious obstacle to Japan's return to the League, and encouraging her co-operation in all international affairs.

Must Face Problem

In thus addressing our fellow Christians in the United States, we would stress need of forbearance and sympathetic understanding of the spiritual aspirations and material needs of all the Oriental peoples; we urge the exercise of a fearless and enlightened conscience in the discernment and support of the moral principles involved in this situation. We believe in facing these problems upon the plane of Christian love rather than that of materialistic self-interest. We assure our fellow-Americans of the presence of this spirit and point of view among many of our Japanese friends, both Christian and non-Christian, and we pledge ourselves to work to the end that in the critical issues before us the advocates of reason and peace on both sides of the Pacific may speak the final word.

Chemical Developments in Japan

The cyanamide calcium industry is showing signs of rapid development in Japan, partly due to the possible adoption of a license system for the fertilizer industry. Several plans have been advanced by business men. Mr. Momosuke Fukuzawa, adviser to the Daido Electric Power Co., and others, will build a factory to produce carbide and calcium cyanamide at the same time. The Electro-Chemical Co. intends to exploit the Waka River, Iwate Prefecture, with a view to going into the calcium cyanamide and alloy industry. The Tobu Electric Power Co. has plans to manufacture carbide and calcium cyanamide near the city of Takasaki.

The Toyo High Pressure Industry Co. has decided to call in unpaid shares to the amount of ¥4,000,000, to perfect an ammonium sulphate plant in course of construction at Omuta, Kyushu. The factory will have a capacity of 152,000 tons.

The Chosen Nitrogen Co., affiliated with the Japan Nitrogen Co., Osaka, intends to go into the metallic magnesium industry in Korea. Chosen Nitrogen has already purchased a good mine in Korea and has signed a contract with the American Syanamid Corporation for use of its patent to manufacture magnesium. The concern plans to market its products next year.

Canton-Swatow Rail Link

Recognizing the strategic necessity of having military communication between Canton and Swatow, the provincial and military authorities here are taking steps for the early construction of a railway joining the two cities.

Eastern Kwangtung, which is close to Fukien, is a vulnerable part of the province and can be defended only by heavy concentration of troops and the erection of fortifications. These sectors have been well garrisoned and fortified since 1931, but the most important phase is to facilitate transportation.

The biggest problem in constructing the railway is the cost which is estimated at about \$15,500,000. There was a suggestion to apply for a portion of the British Boxer Indemnity Funds, but this plan was ruled out owing to the fact that the Ministry of Railways would have no control over the proposed line, which is purely a provincial project.

The authorities are determined to build this line to Swatow, and there is indication of early construction if there is no political disturbance in the next few months.

At present people travel between Canton and Swatow by boarding coasting steamers at Hongkong.

Dredger for Yangtze Bar Arrives in Shanghai

Craft Built in Germany for Whangpoo Conservancy Board One of Largest of its Kind in the World

THE new Whangpoo Conservancy Board's dredger, the *Chien She*, which has been specially built in Germany and will be used for dredging operations on the Yangtze Bar—arrived at Woosung on April 17. Built at a cost of £151,800 and capable of removing 5,000,000 tons a year, the new dredger will first have to pass trials in local water before she is definitely accepted by the Board.

If her trials are successful, a second dredger will probably be ordered, and with two dredgers at constant work on the Bar it is hoped that the channel menace will be removed forever.

The new dredger will go into dock first, and after that will undergo her trials. The new dredger left Danzig on Saturday, February 9, and has sailed out under her own power to Shanghai. Captain Johannsen was in command of the ship and the crew is German. With the exception of some rough weather in the Bay of Biscay the voyage out was smooth.

Conservancy Board officials are optimistic regarding the dredger's facilities, which will not be accepted, in spite of trials in Germany, until it has been tried and tested on the local Bar. Should their hopes be realized, it is proposed to order a second similar type dredger, and with both working more or less continuously, the menace off Shanghai forever will be removed. It is understood that no less than 40,000,000 tons of mud will have to be shifted from the Bar and dumped two miles distant, before navigation problems are completely eased. At the rate of 5,000,000 tons per year, officials feel that within two years, much of the immediate concern will be relieved.

Mr. William Smith, the Board's dredging engineer, supervised the ship's construction, while Lloyd's Register co-operated and several Chinese engineers assisted.

Details of Vessel

In service, the dredger, which is suction drag in type, combines the principles of a vacuum cleaner and lawn mower, cutting a

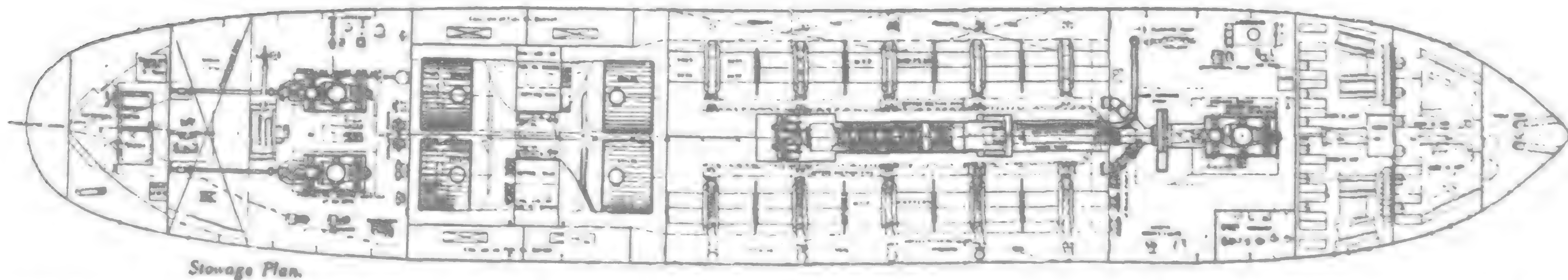
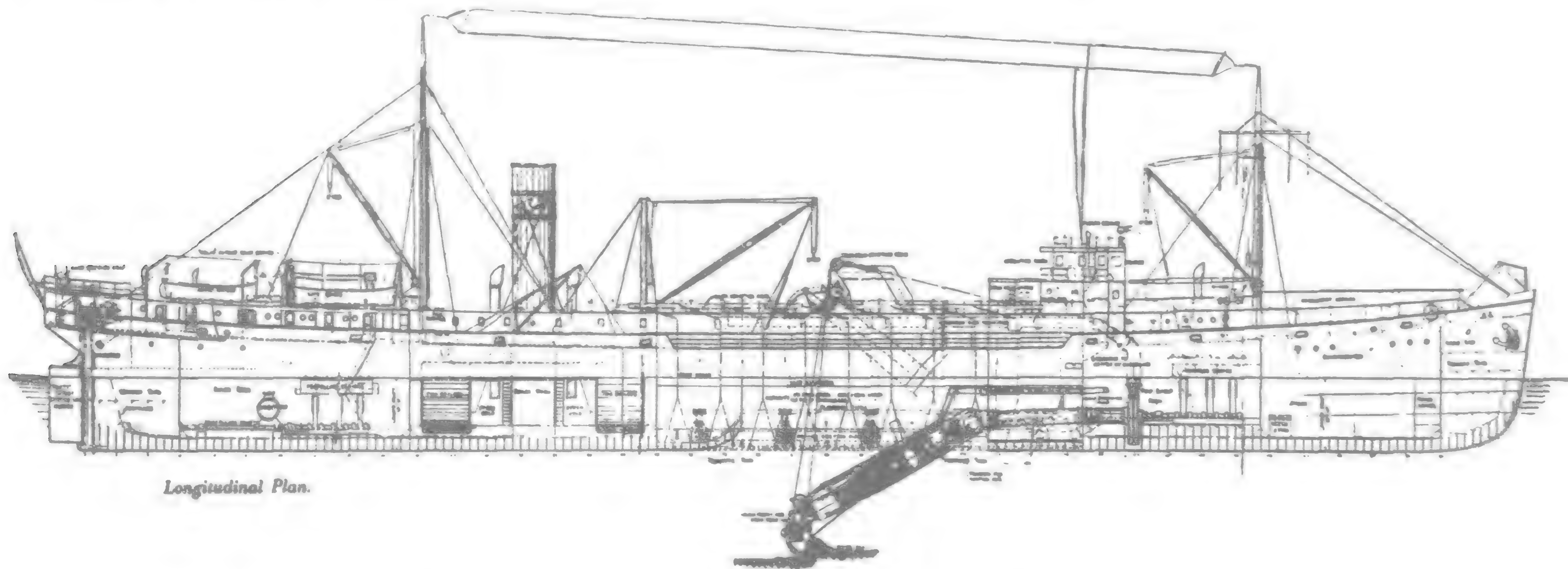
swath about ten feet wide and two feet deep. Loaded with 4,000 tons of mud and water, the dredger having dug a ribbon a mile long, will proceed to deeper water and deposit its cargo. Two means of discharging the mud are incorporated—the bottom may be opened and the silt dropped, or it may be flushed out from the sides.

The dredger, much like another in Buenos Aires, where similar conditions prevail, one of the largest that has ever been built and appears to external view just like a cargo ship. She is 360-ft. long, 60-ft. wide, and when loaded with 4,000 tons of mud, 350 tons of coal, and 150 tons of fresh water, draws 18-ft. The contract speed is 10½ knots. The guaranteed output of the dredger, including the discharge of mud two miles away from the dredging place, is 25,000 cubic yards per day or over 30,000 tons in ten hours. The contract price is £151,800. The general design and specifications were prepared by Dr. Chatley, assisted by the Dredging Department of the Board. The details of the design were made by Mr. Kolkman, the chief technician of Messrs. Schichau.

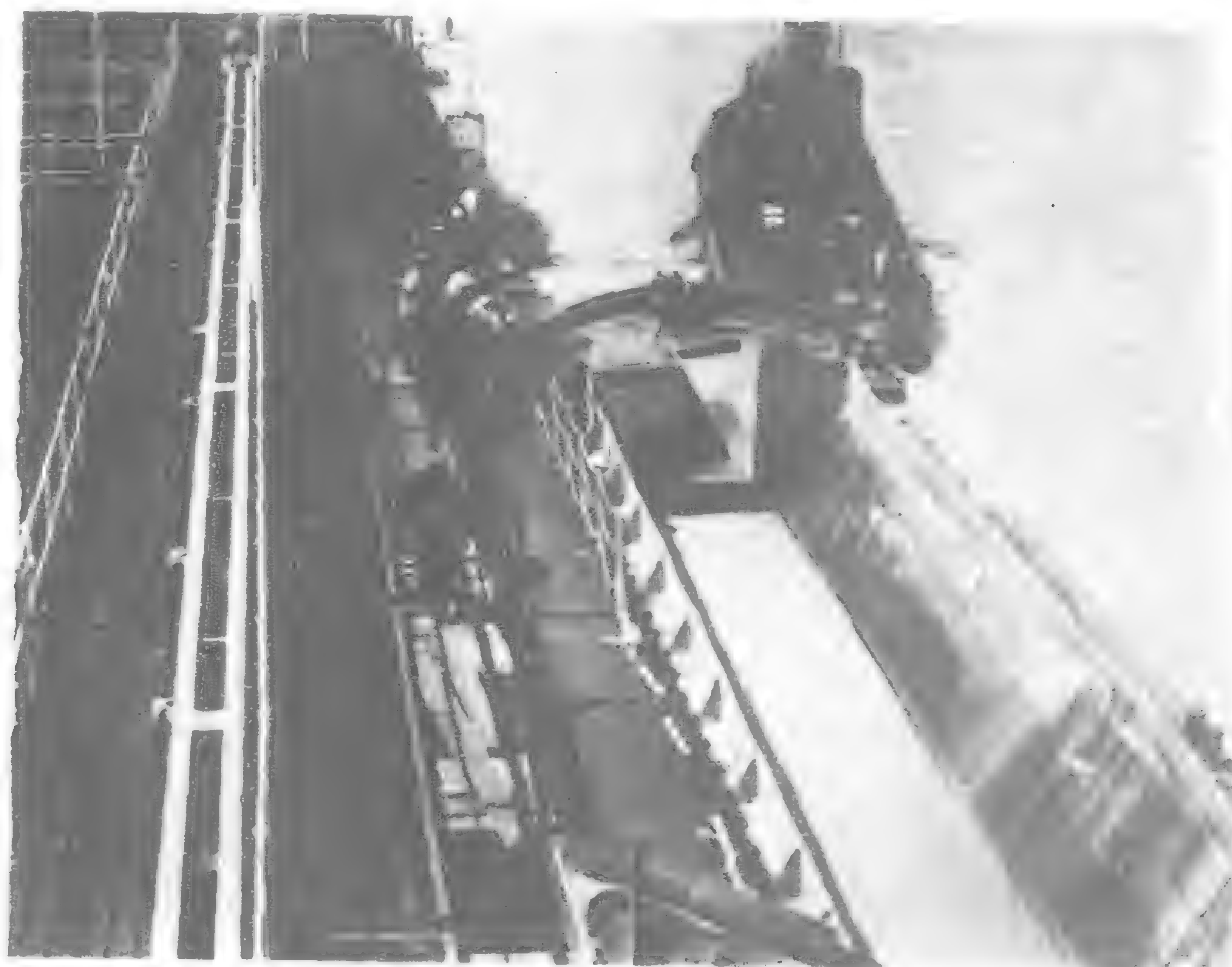
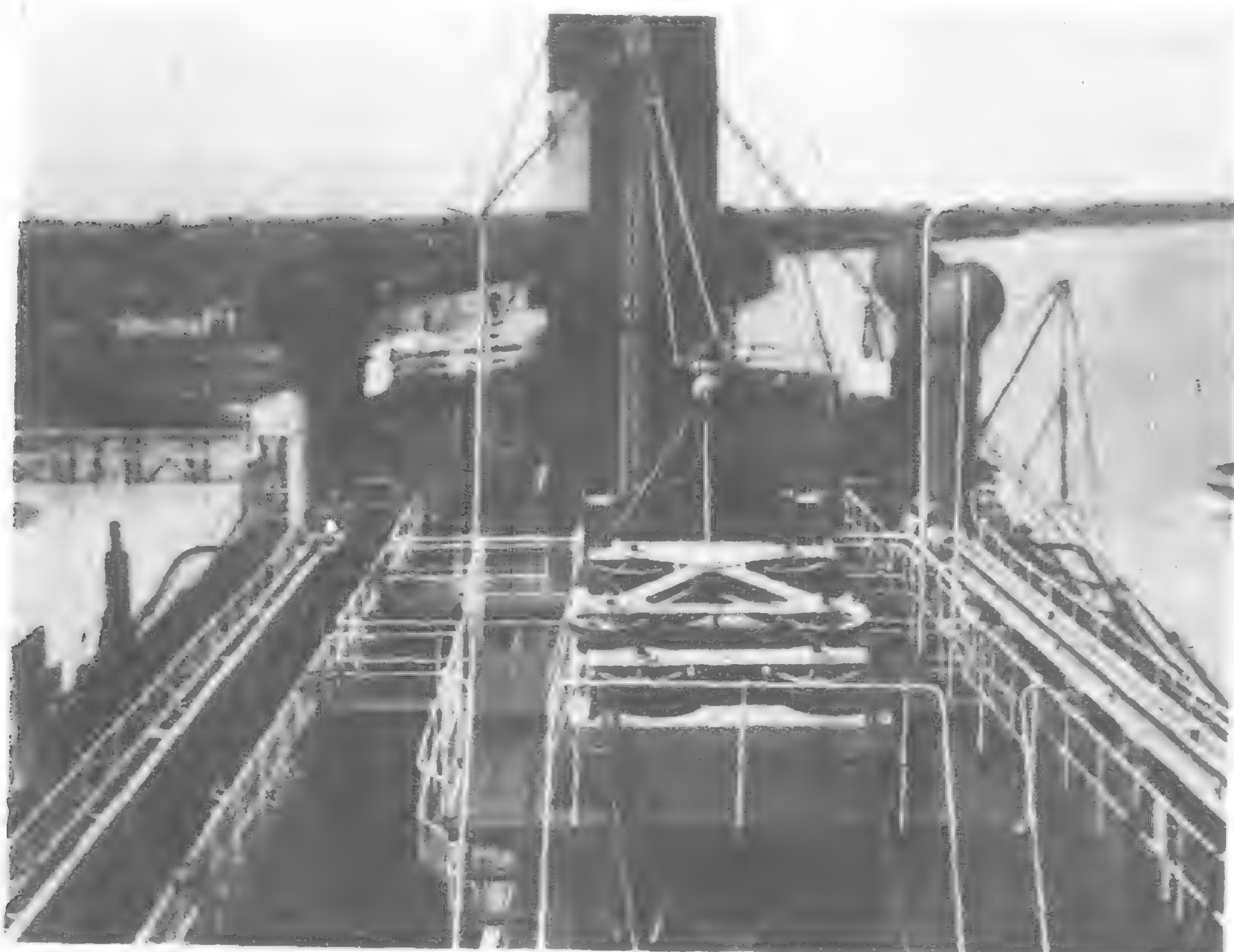
The construction of this particular type of dredger is the result of years of study by the Whangpoo Conservancy Board, the deepening of the channel having been advocated about 60 years ago. As the result of a series of investigations, Dr. Herbert Chatley, Engineer-in-Chief of the Board, made a report on the subject, which was finally adopted by the Government.

First Bids Rejected

In 1931 tenders were called for the first dredger. Owing to various causes, economic and political, no decision was then taken and in 1933, the sixteen firms which tendered were invited to revise their offers. In July, 1933, ten firms made revised offers and these firms included almost all those having special experience in building this particular type of dredger, which is quite different in its operation from ordinary river dredgers. The most favorable offer, combined with large experience of this particular type, was that of the German firm of Schichau.



Twin-Screw Drag Suction Hopper Dredger with Central Well. Dimensions 360 feet by 60 feet 6 inches. Constructed for the Whangpoo Conservancy Board by Messrs. F. Schichau of Elbing, Germany



Two views of the Upper Works of the Dredger "Chien She" taken at the Chang Hwa Pang Wharf. After the arrival of the dredger, coolies discharged bunker coal that was carried in the mud hoppers on the voyage out.

The drag suction type of dredger is the result of an invention made about 1903 by an engineer named Fruehling. Its peculiar feature is that it is not anchored but travels under its own power at a speed of about two knots and scrapes its suction pipe along the bed of the river, thereby forcing the mud into the pipe. A powerful pump draws mud mixed with water up the pipe and delivers it into special containers from which it may be afterwards discharged through doors in the bottom, or by pumping.

Appearing from the outside like a merchantman of approximately the same tonnage, the huge dredger presents an entirely different perspective from within. Other than her motive equipment and supplies, the remainder of the interior is devoted to hoppers, special machinery, and dredging equipment.

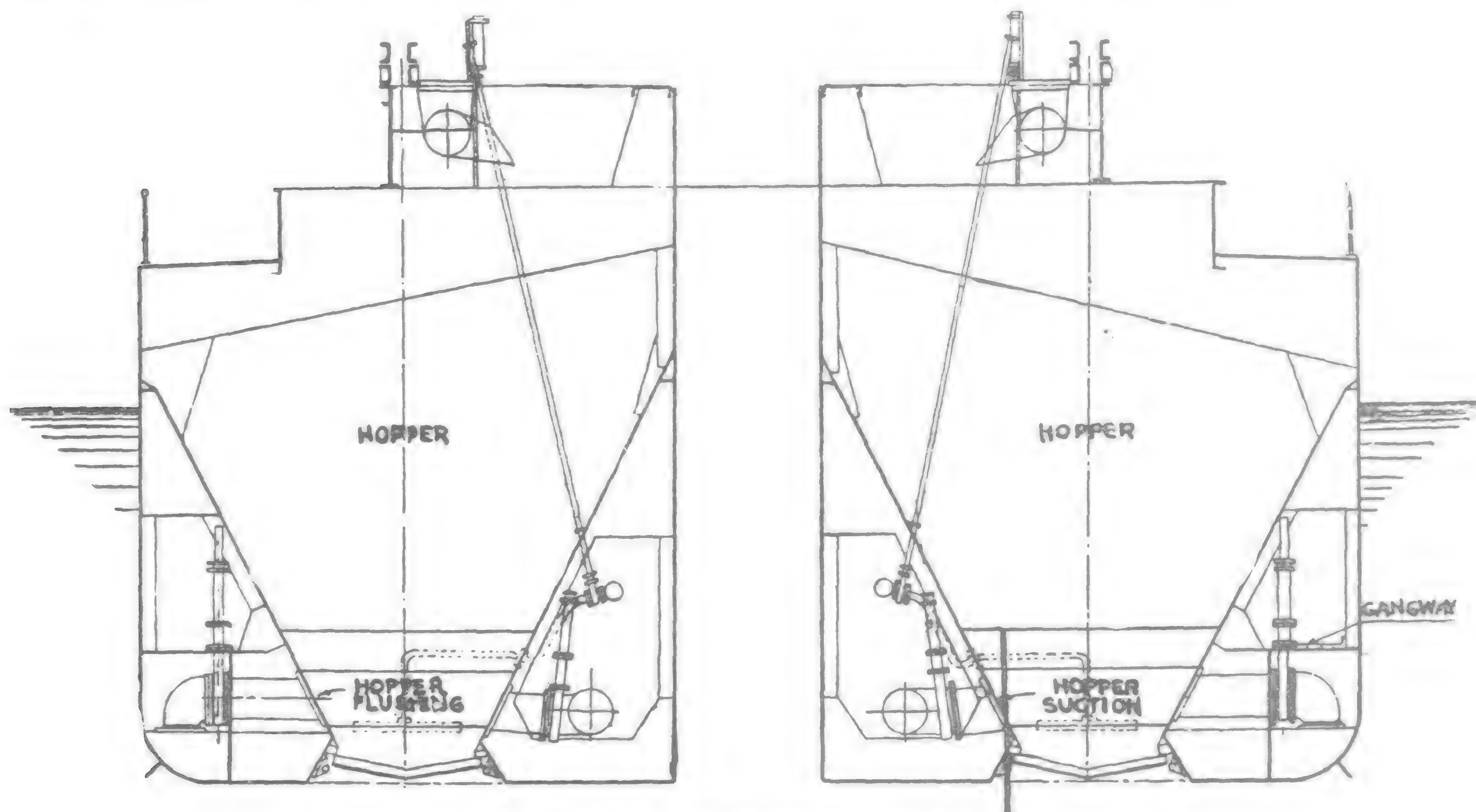
Captain Johann Johanssen characterized her as a splendid vessel and during heavy weather in the North Sea and the Bay of Biscay, the *Chien She* behaved well. They made only two stops between terminal ports, at Port Said and Colombo. Although the specifications call for a speed of more than ten knots, Captain

Johanssen reported that the *Chien She* had done 11.6 on the builders' trials. On the trip out, they averaged nine knots—an economical speed, as was witnessed by the fact that she discharged bunker coal at Chang Hwa Pang.

Captain Johanssen is the chief tester of Messrs. Schichau, who built the *Chien She*. This is the 39th dredger he has delivered safely to many parts of the world on behalf of his principals, including England, France, Russia, Vancouver, B.C., Montevideo, and the Mediterranean—with not a failure to date, he asserted.

According to him, the *Chien She*, although not the largest in the world, will give Shanghai the distinction of possessing the dredger with the greatest daily capacity.

Captain Johanssen will remain in charge of dredging operations for one year, as per contract, with perhaps one or two of the experts remaining with him. He prefers operating the huge machine at a speed of about three knots while on the bar, and cutting a swath six feet deep, dumping his cargo of mud at a distance of two miles and then returning to cut a second swath. In addition



Showing Section through the Hoppers



Two views of the Upper Portion of the Drag Suction Apparatus of the Dredger which will shift 30,000 tons of mud per day

to its other mechanical advantages, the suction drag type will not chop holes here and there, but will cut or "dig" at a uniform depth.

High Efficiency

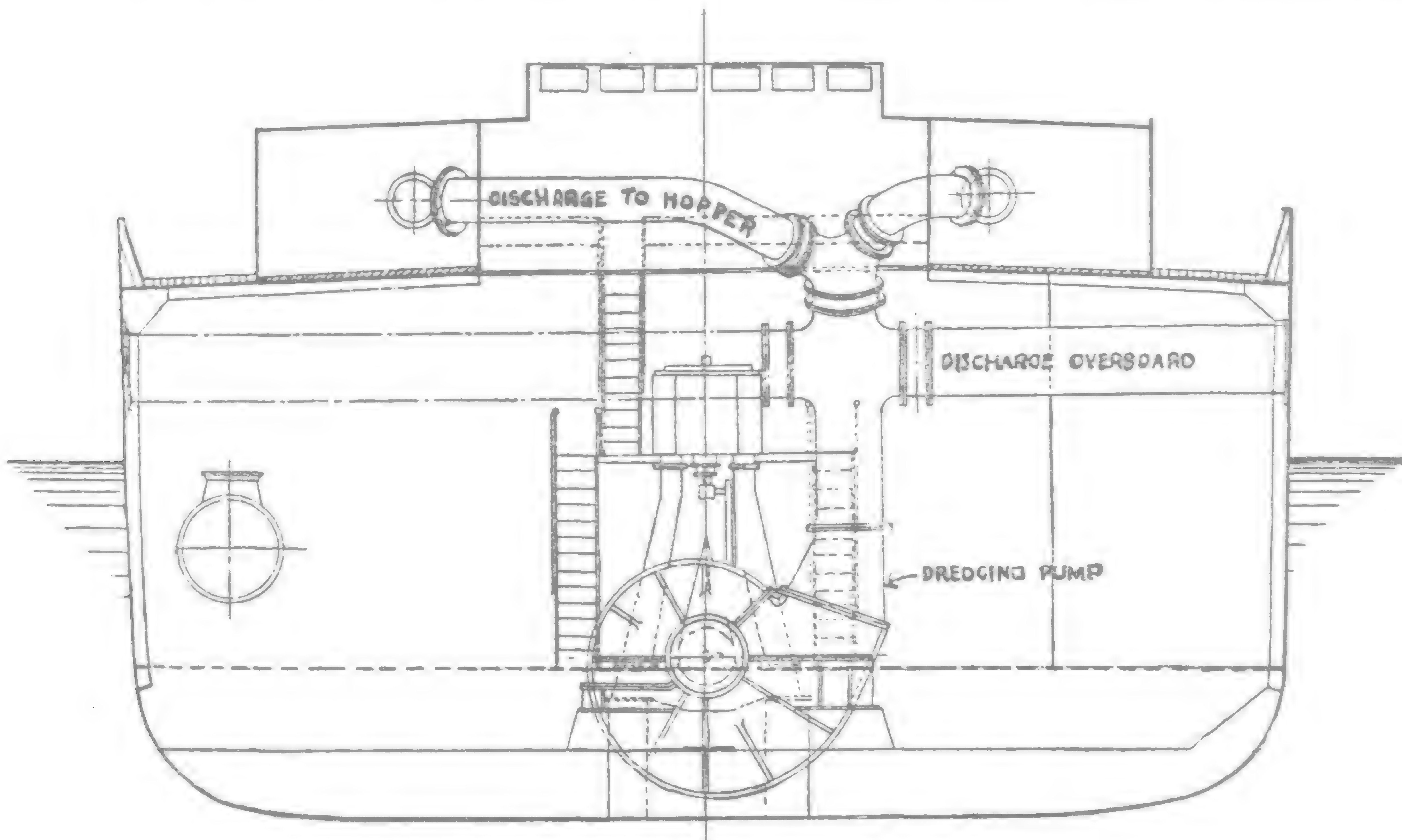
Captain Johannsen indicated that the dredger functioned 90 to 95 per cent efficiently. In other words, his machine scooped up 90 per cent mud and probably less than ten per cent water. In sand, the co-efficient of efficiency was somewhat less.

Another unique feature of the *Chien She*, was its bridge. On the forward side are the navigation instruments, while behind in a special operating room are levers which control every important machine on the ship, and, inasmuch as all were either electric or hydraulic, the officer on duty controlled both navigation and dredging.

Dredging of the Yangtze Bar has not been without major difficulties. As much as 60 years ago, it was recommended that

the bar should be eliminated, but it was not until the advent of the National Government that really serious steps were taken to eliminate it.

The Bar of the Yangtze (generally known as the "Fairy Flats," but actually including other areas, has always been an impediment to ships approaching Shanghai, but in recent years the increased draft of ships and the improvement of depths in the Whangpoo by the Whangpoo Conservancy Board, have made that Bar the most serious obstacle of all. In 1876, Mr. de Rijke, who afterwards became the first Engineer-in-Chief to the Whangpoo Conservancy Board, discussed it. In 1911 the second Engineer-in-Chief, Mr. Von Heidenstam, M.INST.C.E., again called attention to it and under his suggestion a survey of the Yangtze Estuary was made, in conjunction with the Maritime Customs. In 1917 this survey was reported on and on Mr. Von Heidenstam's recommendation and with the cordial approval of the Whangpoo Conservancy Consultative Board, the Whangpoo Conservancy Board



Section on Frame showing details of Dredging Equipment

inaugurated in 1919 a Shanghai Harbor Investigation. This culminated in 1921 in the convening of an International Committee of Consulting Engineers. Included in the matter prepared between 1919-1921 and submitted to this committee was a project drafted by Dr. Herbert Chatley, M.INST.C.E. (Engineer-in-Chief since 1928) for the dredging of the bar by the drag suction method invented by Otto Fruehling in 1903. The International Committee reported in 1921 endorsing this proposal and the matter was before the Government until 1930, when with the support of Mr. Soong Tseliang, the Administrative Yuan recorded the Board as charged with the work.

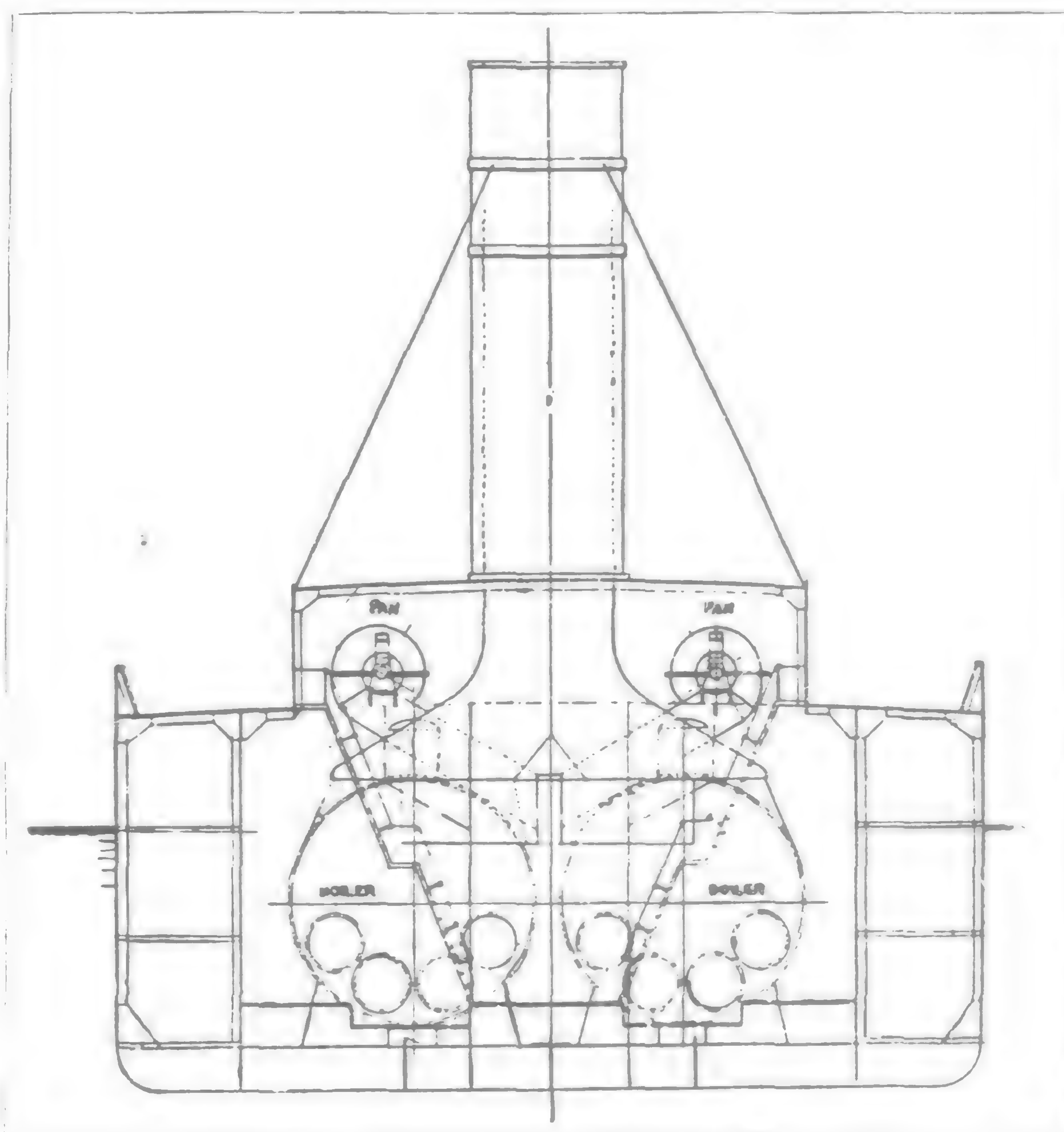
Description of the Bar

The Bar of the Yangtze is over two miles wide and the length in which it affects deep-draft ships is about twenty miles.

To make a navigable trench in the Bar, 1,000-ft. wide and with a bottom level 9-ft. below the crest of the Bar involves the removal of over 20,000,000 cubic yards of mud. In order to achieve this in a reasonable time and keep ahead of the re-silting which will occur, dredgers of the largest possible capacity are required. The final technical conclusion came to was that an annual output of 10,000,000 cubic yards of mud should be aimed at. For this at least two dredgers would be necessary and the drag type which is not anchored but dredges a long shallow cut while moving was decided to be the only one which offered reasonable hope of success.

Invitation for Tenders

In January, 1931, a world-wide invitation to submit designs and tenders for the first dredger was sent out by the Board. In September, 1931, sixteen firms offered designs at prices varying from £96,000 to £153,000 for types using saturated steam. Many of the designs were unsatisfactory and only a few firms offered the required guarantees. Directly after the tenders were received the British Government abandoned the gold standard thereby



Section through Boiler Room of the Dredger

of speed, excessive fuel consumption and delay in construction, as well as giving the Board an option of total rejection if the output is less than 22,500 cubic yards of mud per day (dug and transported two miles). There is also a clause penalizing the firm up to £15,000 in the event of improper tending of commissions, presents, etc., to any director or employee of the Board.

The propelling machinery has about 2,500 h.p. and the pumps about 2,500 h.p., totalling about 5,000 h.p. The furnaces burn coal or oil. When dredging the vessel will travel at a speed of about two miles per hour over the bottom with the shovel-shaped end of the suction pipe hooking 2 or 3-ft. into the mud. The pipe can be lowered to cut to 45-ft. below water level. The pump will lift a thick mixture of mud and water up the pipe into the hoppers. The general arrangements have been prescribed in a highly detailed specification prepared by the Engineer-in-Chief, Dr. H. Chatley, M.INST.C.E., assisted by the late Mr. J. G. Irvine, M.E., Mr. P. N. Fawcett, M.INST.C.E., and Mr. W. Smith, M.INST.N.A. The actual design was made by Mr. Kolkmann, technical expert to Messrs. Schichau.

throwing the comparison of prices into confusion. Furthermore, the Manchurian and Shanghai incidents upset the economic conditions in China and it was decided in December, 1932, that new tenders should be called for. The sixteen firms who tendered in 1931 were invited to submit fresh offers in accordance with a revised specification and detailed contract.

Ten firms tendered in July, 1933, and after careful scrutiny it was decided to place the contract with Messrs. F. Schichau, of Elbing, Germany, for the sum of £151,800, English currency. This firm had been the most favorably regarded in the 1931 proposals and voluntarily offered to renew the guarantee of 90 per cent output against penalty of total rejection. Owing to the depreciation of sterling this price represents an appreciable saving against the 1931 offer, which can be set off against the loss of time. The contract prescribes severe penalties for shortage of output, deficiency

Japan-Manchou Railways

Fundamental reorganization of the South Manchuria Railway system on the event of satisfactory conclusion of the North Manchuria Railway transfer agreement, has become almost a foregone conclusion. The scheme expected to be put into effect is the establishment of a Japanese-Manchuokuo transportation company which will administer all the state railways of Manchukuo (including the N.M.R. after its transfer to that state), and the present S.M.R. system.

Since the Manchurian incident and the accompanying change of circumstances in Manchuria, the S.M.R. has been facing the need of drastic revamping, but the necessary changes had been held in abeyance in anticipation of an opportune occasion for its execution.

However, the recent transformations in Manchuria have been such that the change cannot be very much longer postponed, particularly when the N.M.R. comes under Hsinking ownership.

The transportation company to be established will also supervise the harbor enterprises, coastal and river navigation, and shipping undertakings as subsidiary projects.

In this connection, two years ago when the S.M.R. revamping scheme came to the fore, the company held firm to its stand that

the railway enterprise cannot be separated from the coal mining undertakings, but recent developments show a trend toward separate administration of the two enterprises.

The reorganization plan now under examination will require considerable time before actual materialization due to the relations of the revamping scheme with the Nippon-Manchuokuo Economic Commission soon to be established, the final conclusion of the N.M.R. transfer accord, and the political situation in Tokyo.

The final signing of the N.M.R. transfer agreement is expected in the very near future, and subsequent to the transfer of ownership, it is clear that the Hsinking authorities will commit management of the N.M.R. into the hands of the S.M.R. as it has already turned over the present state system. On that occasion, the 6,000 odd kilometers of Manchukuo lines will be put under single management.

Many financial and technical problems, however, accompany the joint management by the S.M.R. of its own system and the Manchukuo state lines, although the consolidation of all the railway lines under S.M.R. administration must be said to be an epoch-making event.

Tender for New Dredger Built in Shanghai

A SPECIAL service vessel built by the New Engineering and Shipbuilding Works, Ltd., at Shanghai for the Whangpoo Conservancy Board is the s.s. *Li Liang* which will work as a tender with the huge suction dredger *Chien She* from Germany.

At Woosung a wharf has been built to accommodate the dredger and tender. The *Li Liang* in addition to acting as feeder for the dredger, will undertake survey and buoy work as the dredging proceeds. The task is one of great magnitude. The *Li Liang* as a floating storehouse and workshop with special equipment for handling buoys and pumps and tanks for discharging oil for the dredger at sea. A searchlight and an echo-sounding device are other features, and the equipment includes a wireless telephone, which will keep the Custom House in touch with her.

The vessel has a lower, main, forecastle and boat deck, and the main dimensions are:—Length overall, 150-ft.; moulded breadth, 30-ft.; moulded depth, 16-ft.; loaded draught, 10-ft. She is built of steel, and is subdivided into seven watertight compartments by six watertight bulkheads extending to the main deck. The vessel has a raked stem and cruiser stern, and has been built with two steel decks, sheathed with teak and Oregon pine. The petty officers are located on the main deck and there is accommodation below for a crew of 20.

The Machinery

A powerful combined steam windlass and capstan of naval pattern is installed on the forecastle head for the efficient handling of the anchors, also two five ton winches for handling buoys; a steam capstan is fitted on the main deck aft with suitable leads for warping and handling the ships' cutter and gig. The vessel is also fitted with steam steering gear.

The propelling machinery for this vessel has been specially designed and constructed by the builders at their Yangtszepoo yard, and consists of two sets of three crank triple expansion,

surface condensing engines developing ample power to give the vessel a speed of over 10½ knots, and operating under steam supplied by one single-ended three furnace, cylindrical Scotch boiler, also designed and constructed by the builders, burning coal under the well-known "Howden" system of forced draught, and operating at a pressure of 100 lb. per sq. inch. The auxiliary machinery is of the best modern type, all independent of the propelling machinery, and includes a surface condenser of the regenerative type, of mild steel, common to both engines, one Weirs Paragon air pump, one centrifugal circulating pump, two Weirs main feed pumps, and one Weirs feed heater. An ash ejector pump and a bilge and general service pump are also fitted.

The vessel is lighted throughout by electricity, current being supplied by duplicate sets of Diesel-engine driven generators. One searchlight and a Marconi wireless installation and an Echo sounding machine, of Henry Hughes and Sons' make, form part of the equipment.



Special Service Vessel "Li Liang" built to work as a Tender with the New Giant Dredger from Germany, "Chien She"

Japanese Railway Project

Tokyo's constantly increasing railway traffic has necessitated enlargements of facilities which will virtually double the extent of Tokyo station and will necessitate new switching space of 160,000 square yards at Shinagawa. The extensions will result in general speeding up of service through the capital.

At Tokyo station railway engineers plan to build three platforms, bearing six lines of track, on 44,000 square yards of the present switching grounds in the rear of the station. The plans call for an addition to the station building proper on the side facing Yaesu Bridge, the addition to be nearly as large as the present structure.

The increase in trains will necessitate the new railway yard at Shinagawa, and it is proposed to extend the existing yards at Oku, above Ueno, and at Tsurumi, which are used chiefly for the handling of freight trains. Two additional tracks are to be laid between Tokyo and Yokohama, and express trains will be added to the service, the Tokyo-Yokosuka trains operating on a 10-minute schedule during rush periods.

When the improvements to Tokyo station are completed, trains on the Tokaido and Tohoku trunk lines can be brought into direct connection either with Tokyo or Ueno station, and trains on the circular belt line can be operated at intervals of two minutes instead of the present four-minute schedule.

The work is to be started early this year, the *Asahi* said, and the schedule calls for completion at the end of 1938. No definite total has yet been set, but the estimated cost is Y.38,500,000.

Automatic 'Phones for Colombo

Colombo may have an automatic telephone exchange as a result of the decision made last week by the Executive Committee of Communications and Works.

The decision will affect a large number of Colombo's "Hello Girls."

A number of them, however, will continue to serve the Department for trunk work.

It is understood that the members of the Executive Committee inspected the Central Telephone Exchange, before holding the meeting at which the question was discussed, and, apparently, went away convinced that the time had come for Colombo to be more modern in its telephone facilities.

The scheme drawn up by the Chief Engineer of the Telegraph Department, which was approved at the meeting, provides for the early substitution of the switchboard at the Central Exchange by automatics.

After that step, the work will be continued at the Havelock Town Exchange, and, later, a new exchange at Maradana.

The installation of automatics will enable all subscribers, with their automatic telephones, to dial each other direct, doing away with the necessity of operating.

It is understood that the scheme includes the provision of a suitable building to accommodate the necessary equipment.

Improvements in the Yangtze River Delta*

By *ING. L. BRANDL, Formerly Director of Danube Regulation Commission, Consulting Engineer, Yangtze River Commission*

THE conditions in the delta of the Yangtze River are of great importance to navigation which uses this main communication artery to reach the interior of China, or to reach Shanghai, the largest port in China.

In Shanghai at present, thanks to the work of the Whangpoo Conservancy Board, even the largest sea-going vessels of the highest draughts, can go alongside and discharge cargo. A condition for the utility of this world-port is the navigability of the fair-way through the mouth of the Yangtze River to the mouth of this port (Whangpoo mouth).

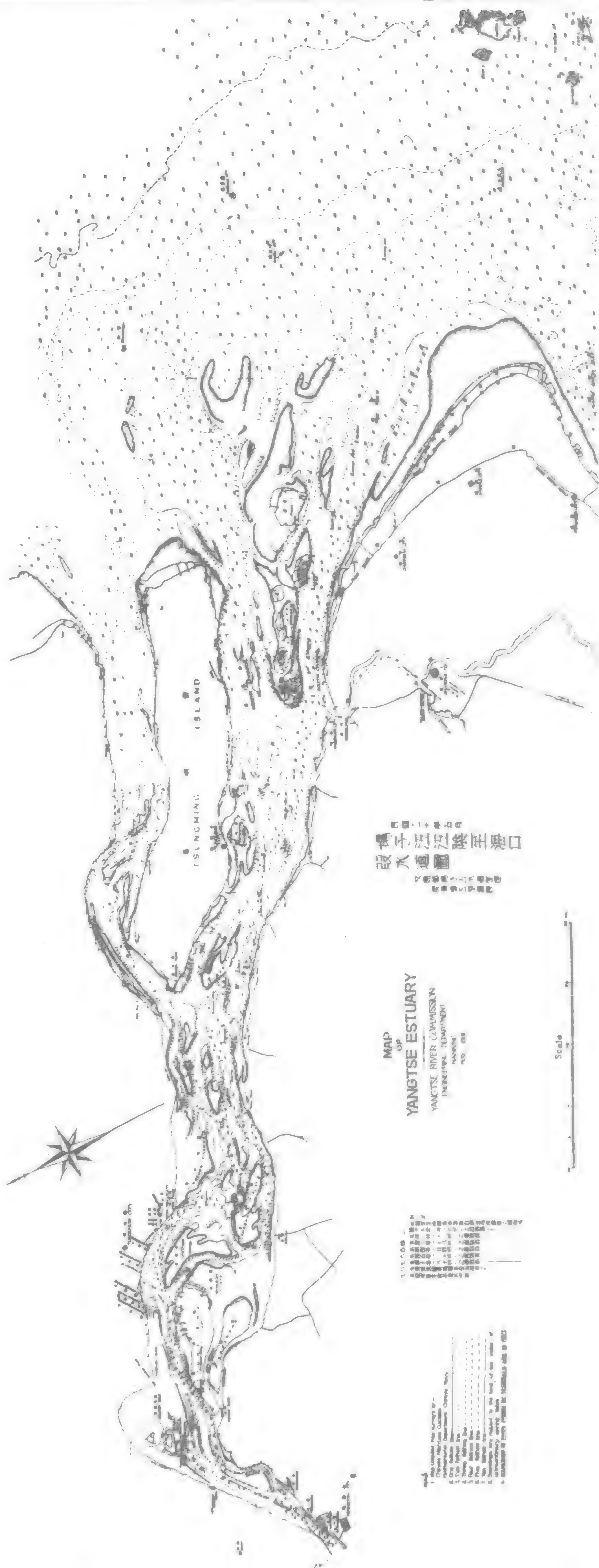
The mouth of the Yangtze River consists of three branches, the Haimen Channel, the North Channel, and the South Channel. At present the South Channel is the pass which all the larger vessels must take to proceed up the Yangtze River or to reach the port of Shanghai. This branch, as a rule, offers the most favorable navigation facilities which are only influenced by the mud and sand deposits at the so-called Fairy Flats. The removal of these deposits is at present one of the most important problems for the entry into the port of Shanghai, and the Whangpoo Conservancy Board therefore intends to undertake a thorough dredging at this point. The largest dredging apparatus of the world is to be built and put into operation here.

It is a well-known fact that deposits take place at every port entry and that repeated annual dredging is necessary. Economy calls for making an effort to reduce to the absolute minimum this dredging by a corresponding shaping and position of the mouth of the port as well as of the adjacent riverbed.

It is natural, of course, that in view of the enormous dimensions of the riverbed of the Yangtze River and the economic conditions prevailing, this riverbed alongside its banks can not be hemmed in by continuous breakwaters or dams as, for instance, has been done with rivers in Europe. Nevertheless, it is possible to stabilize the navigable water conditions of the existing pass and thereby reduce to a minimum the mud and sand deposits which at some parts are unavoidable.

So far in the Yangtze Delta no provisions have been made in this direction and the gradual change of the conditions of the navigation passage, as alluded to in the report of the Whangpoo Conservancy Board of 1917, will in future find its continuation if nothing is done regarding stabilization. This is of particular importance in respect to entering and leaving the port of Shanghai.

The South Channel of the Yangtze River which is the entrance to-day, shows unfavorable, quickly changing width conditions. Above the mouth of the Whangpoo River, near Plover Point, the riverbed divides into two main branches which embrace Tsung Ming Island. At the parting point the main riverbed has a width of approximately 16 kilometers. The northern branch of the Haimen Channel which has an initial width of six kilometers, widens out towards its mouth to a width of 13 kilometers. The southern branch commencing between Mason Point and Green Point with a width of about 12 kilometers, narrows downstream to a width of nine kilometers and widens again near Paoshan to a width of 16 kilometers. Here it divides again into two branches, the North Channel with an initial width of nine kilometers and the South Channel with, near the



*Journal of the Association of Chinese and American Engineers

division point, a width of six kilometers narrowing down to some four kilometers immediately below the Whangpoo River. This narrow passage has a length of say 20 kilometers, whereafter, near Kiutoan, another rapid broadening to seven kilometers takes place, which at Fairy Flats increases to about 14 kilometers. In this narrow stretch, according to sounding maps of 1931 (later data were not at the disposal of the author) there is available at least 30-ft. at low water mark through a navigable stretch more than two kilometers broad. Below the above-mentioned broadening this favorable passage narrows very quickly so that at the shallow parts of the Fairy Flats only a depth of 15 to 16-ft. is found.

How favorable a longer enclosed water-way proves itself may be seen from the riverbed conditions of the narrow stretch as compared with the stretches situated upstream where water depths of more than 30-ft. are also to be found. But in the narrow stretch mentioned the navigable depth is almost regularly a minimum width of two kilometers whilst upstream same is found in many winding branches of changing widths narrowed down by more or less expanded mud and sand deposits. The regular shaping of this stretch is also illustrated in the diagrams, Plates No. 17 and No. 18 of the report of the Whangpoo Conservancy Board *re* "Hydrological data for the Yangtze Estuary up to 1918." In these diagrams the cross sections in profile along the narrow stretch upstream and upwards from the mouth of the Whangpoo River are given as more or less regular with about 500,000 square feet at low water mark and 850,000 square feet at high water mark.

The regularly favorable development of this stretch, almost closed in on both banks, proves that by regulation work success can be achieved.

That such improvement work in the delta is absolutely necessary is also to be seen from the above-mentioned report of the Whangpoo Conservancy Board, *vide* Plate No. 21, showing diagram of mud contents. It shows that the mud contents in the stretch above Kiangyin continually decrease, but below this point, i.e. at the delta area, continually increase. The cause of the increase in the delta area obviously is the attack of the flood tides on the bank edges and the bed of the expanded irregular side branches and islands in it. This increase of the mud contents must be deemed as considerable, when one considers that according to the diagram mentioned the annual average mud contents in the year 1917, from

Wuhu to Kiangyin decreased by say 42 per cent and from Kiangyin increased by approximately the same amount.

It is beyond doubt that the mud contents are larger in proportion to the greater possibilities of inroad offered to the current, the more irregular the bed is in form, and the less the transportation power of the stream is. Therefore attempts should be made to create in the place of the straggling bed of the delta area, interspersed by many branches and islands, a bed as nearly uniform as is possible, which offers lesser possibilities of inroad. Although the velocity of the current may be greater in a uniform bed than in some of the shallower side branches, one has to take into consideration that some side branches have excessive depths where locally greater velocities and gullyng-out take place, but that the greater velocity in a uniform bed also creates larger transportation power. By this greater transportation power suspended matter in a uniform bed is carried on without disadvantage and is not deposited at inconvenient places if the broad dimensions of the bed do not change suddenly but only gradually.

In order to lend unity to the straggling of the stream bed in the delta area, it will be necessary to cut off or remove certain side branches which cause a breaking-up of stream power.

The three existing main branches should be shaped in such a manner so that as large a flood stream as possible can enter the delta area to find there a bed stretched as uniformly as possible and that a strong ebb stream as concentrated as possible goes through that main branch, which must serve as a passage for navigation. The ebb stream must be as powerful as possible in order to possess a corresponding clearing power for the further transportation of suspended matter.

The bed of this main branch, serving as a passage for navigation, should, if at all possible, be bordered by protected banks and gradually broaden to a funnel shape towards the open sea.

How regularly a uniformly closed profile is formed, is shown by the repeatedly mentioned narrow stretch upstream and downstream from the mouth of the Whangpoo River.

In the interests of the most economical and permanent success of the projected dredging at the lower end of the South Channel, it would be desirable to carry into effect throughout the delta area of the Yangtze River such a scheme as herein outlined. Thus, to as great an extent as possible, would be reduced the unavoidable deposits at the entry.

Tin Mining Prospects in China

There is a general impression in tin circles that the Chinese production of tin is definitely on the increase not merely from Yunnan but from deposits in other parts of the Republic. In this connection the *Chinese Economic Bulletin* recently contained the statement:—

The Chinese authorities in Kwangsi province are making elaborate preparations for the development of the tin mines at Fuchuan, Chungshan and Hohsien, where the total mining area is estimated to cover hundreds of square miles, and the mines are believed to be capable of producing nearly 20,000 tons of tin ore a year for a period of over 70 years. Although Yunnan is an important tin-producing province, its output is not sufficient for home consumption (*sic*), and the balance is imported chiefly from Singapore. As the current market price of tin is comparatively high, Kwangsi authorities believe that it will be very profitable to work these mines. As a preliminary step, a Mining Bureau was organized last year, and after careful prospecting during the past twelve months, the Bureau's experts have obtained very satisfactory results regarding the contents of these mines.

The rich tin mines of the three districts named have long been known, and at many places the mines have been worked by old methods. As these mines cannot be made to yield ores to the fullest extent without the employment of modern machinery, seven or eight large companies have been started to work the ore with better equipment. Of these, four are already in operation. Miners using old methods generally work individually, and their number is estimated at over 10,000, but their total yearly output is less than 900 tons. The only disadvantage in the development of the new mines is the absence of transportation facilities, as these three districts are located in mountainous districts. To work the mines, the Kwangsi authorities have decided to establish in the near future a power plant of 2,500 kw.

In China much tin was once used in making tin-foil for the production of "joss" money. Shaoshing, in Chekiang province, is the principal center of this industry, and every year large quantities of tin from Singapore are consumed in the Shaoshing tinfoil factories. In recent years the tinfoil making industry has declined. China's consumption of tin has shown an increase, as tin is used in the food-canning industry, which is growing very rapidly in many provinces. There are fruit, meat and other food-canning factories, which consume millions of cans a year. A can-making factory is operating in Shanghai turning out cans from imported tin.—*The Mining Journal*.

Tin in Southern China

The development of tin mining in Southern China is a matter of importance to Malaya, especially as China is not under restriction. Yunnan has been well known for many years as a tin-producing province and from Chinese published statistics it now appears that it is proposed to develop and equip with modern plant several mines in the old mining fields in the north-east of Kwangsi in the district of Ho-hsien and Fu-chuan-hsien. It is stated that the total within five known productive areas amounts to about 650 square li. Difficult overland transport has been an obstacle to development in the past, especially during the dry winter months when the tributary of the West River, which gives access to the district, ceases to be navigable. Against the probably optimistic statements in Chinese records as to prospective developments it has to be remembered that China consumes a considerable quantity of tin in making tinfoil and also that the actual export of tin has decreased in recent years.—*The Mining Magazine*.

The Works of the Tokyo Gas Co., Ltd.

By WALTER T. DUNN, M.I.Mech.E.

DURING his attendance at the World Engineering Congress the writer, through the courtesy of his friend Mr. Sakura Okamoto, M.INST.GASE. (Vice-President of the Tokyo Gas Co.), had the opportunity of enjoying specially accompanied visits to the various works owned by the stupendous undertaking having its headquarters at Tokyo.

Readers of the *Far Eastern Review* will recall that the World Engineering Congress was opened by H.I. Prince Chichibu in the magnificent municipal building at Tokyo and mention of his name may justify some reference to the keen interest which he takes in every movement having for its object the progress of his beloved country.

In Japan His Highness is known as "Our Prince," and is as popular in that country as The Prince of Wales is in England. At the time of the great earthquake the Japanese Prince was staying at Tamozawa Imperial Villa at Nikko. On receiving the tragic news of the catastrophe he promptly departed for the devastated area remarking "Now that the First Division is mobilized I can no longer stay here at ease." On arrival at Tokyo the Prince rode all over the city in face of grave danger, encouraging helpers everywhere in their work of rescue.

As a sportsman Prince Chichibu is famous. In 1923 he first explored the Japanese Alps, climbed Fujiyama, and also the most difficult mountains in the vicinity. These adventures he described in a book "A Trip to the Mountains." Later, in the company of the Marquis Moritatsu Hosokawa and Mr. Aritsune Maki, the Prince climbed the Alps Ranges by way of Tanderwald, Switzerland, through which exploits he became recognized as the Prince Mountaineer, and was elected an Honorary Member of the Alpine Club. He was the only royal member of that distinguished and exclusive mountaineers' club.

On May 28, 1925, Prince Chichibu left Japan on *H.M.S. Izumo* for studies in England. After visiting various countries in Europe, on October 14, 1926, he became a graduate of Magdalen College, Oxford University. His period of stay there however was unfortunately curtailed, owing to the illness of his father Emperor, and consequently the Prince left England to return to Japan on December 22, of the same year.

Sir John Tilley, British Ambassador to Japan at the time of the World Engineering Congress, in a speech at the banquet in honor of the diplomatic corps said: "Any enterprise or undertaking, whatever its nature, with which Prince Chichibu associates himself never fails to achieve success in Japan or abroad. It is needless to explain that this is due to the excellent personal characteristics of His Imperial Highness."

The inaugural ceremony of the Congress, in connection with which the writer visited the Tokyo Gas Works, was presided over by Prince Chichibu at the Nippon Industrial Club on July 26, 1928. The Tokyo Sectional Meeting of the World Power Conference was inaugurated at the Peers' Club on September 20, 1929. Next month the writer was present at the opening ceremony of the Congress, which was indeed most brilliant, representatives from all parts of Japan and from abroad attending. Their

respective greetings were presented and were graciously acknowledged by the Prince, and high Japanese government officials.

In the varied and comprehensive program which was gone through were included inspections of all the industries for which Japan has established for herself a world-wide reputation. Not the least interesting of these to the writer were the works throughout the country engaged in the manufacture of coal gas. He received every courtesy and attention wherever he went, and desires now to acknowledge the kindness of those whom he met. As to the establishments of the Tokyo Gas Company the following information and accompanying photographs were subsequently supplied to him by Mr. Okamoto.

Offices and Directorate.—The main offices of the Company are in the Tokyo Kaijo Building, Tokyo.

The Board of Directors consists of Messrs. Takashi Isaka, Sakura Okamoto, Hanroku Ohta, Kunizo Hara, Keisaburo Hashimoto, Nobuo Tsuru, and Yejiro Iwamura: Messrs. Kango Koyama and Hyosuke Sekiya are the Auditors.

The Officers of the Company are as follow:—*President*—Takashi Isaka: *Vice-President*—Sakura Okamoto: *Managing Directors*—Hanroku Ohta, Nobuo Tsuru, Yejiro Iwamura: *Standing Auditor*—Kango Koyama: *Chief Engineer*—Tamotsu Watanabe: *Secretary*—Keizo Kamiya: *Chief of Office Managing Division*—Mikichi Ishikura: *Treasurer*—Kan Kitamura: *Chief of Business Division*—Naonoshin Sogabe: *Chief of Engineering Division*—Tsuruo Yeguchi: *Chief of Supply Division*—Kiyoshi Ito: *Chief of Examining Division*—Tamotsu Ishii.

Historical.—The gas industry of Japan originated with the introduction of street gas lamps in the year 1870 by the German Consul Von Adolp Reis, by which means Yokohama was lighted in 1872. About this time the dawn of the new era of Meiji was breaking in Japan. Reformation and reorganization of all social and political systems were proceeding. Any new ideas brought by western civilization during this period created a very deep impression on the people. Gas was one of the new introductions in which the Japanese people took an unmistakeable interest.

At that time, there was also a proposal to establish a gas industry in Tokyo, and it was realized in 1874. Originally the gas business there was maintained by a Public Fund set aside as emergency savings of the feudal Shogunate government, and was placed under the supervision of the City Authorities. In 1885, however, the business was transferred to private ownership for the purpose of encouraging its further development. Thus was the Tokyo Gas Company brought into existence on October 1, 1885.

Subsequently, owing to favorable economic conditions succeeding the Russo-Japanese War of 1904-1905, it was proposed to establish a competing company in Tokyo with a concession granted by the city authorities, who had fallen into the mistake that competition between rival companies in the same locality might result in lower prices and better services. In 1910 the concession was at length given to the Chiyoda Gas Company, Ltd. Bitter competition was going on between both sides. Each declined to



Fig. 1.—Coke Handling Plant at Tokyo Gas Company's Tsurumi Works



Fig. 2.—Kopper's Type Chamber Ovens at Tokyo Gas Company's Omori Works

utilize a considerable surplus fund, and, before long, was obliged to borrow money to continue the strife. The unsatisfactory state of affairs resulting from this direct competition led to efforts being made to effect an amalgamation. The Tokyo Company thereupon united with the Chiyoda Company, and at the same time, by entering into a compensation contract, was granted a monopoly in providing the services. In return for this advantage the company was subject to City Regulations, primarily in order to prevent the imposing of exorbitant prices. In later years, when it was proposed to establish new competing companies in the suburbs of the City, it was but right that the Official Committee of the Gas Industry should raise strong objections.

Territory and Business.—The Tokyo Gas Company sells its gas to domestic consumers, as well as to those requiring large supplies. Directly or indirectly it serves a territory of approximately 858.17 square kilometers, containing a rapidly-growing population, estimated to be more than 5,500,000.

The following Table gives an impression of the Company's area, and is taken from the census of October 1, 1930.

District	Sq. Km.	Population	Number of Household
Tokyo City	559.24	4,097,669	850,783
Kitatamagun in Tokyo Prefecture	252.64	134,829	23,878
Part of Kanagawa Prefecture	33.02	114,289	24,124
Part of Saitama Prefecture	2.12	29,735	6,198
Totals	838.02	4,376,522	904,983

The City of Tokyo records a steady annual increase in population averaging 140,000. About 35,000 reside in dwelling houses. The total population is about five millions and a half, about 1,100,000 being residential. In the near future it is intended to complete the new system of the Tokyo Tosei, which will unite all the departments in the Tokyo Prefecture. The area for the development of the Gas Company's business is therefore particularly favorable.

The Tokyo Company is selling gas to the Tsurumi Gas Company, Ltd., one of the subsidiary Companies, having an area of 20.15 sq. kilometers in the Tsurumi division of Yokohama City. The Table given below shows the position of this Company :—(Census, October 1, 1930).

Tsurumi Division of Yokohama	Area Sq. Km.	Population	Number of Household
	20.15	81,202	17,581

Kanagawa and the Tsurumi area are regarded as the center of the new industrial section of Japan, so that gas is, and is likely to be, employed for numerous trade purposes.

Business Development.—The Company's early position is indicated by the following figures for the year 1885 :—

Capital Yen	Paid up Capital Yen	No. of Shareholders	Income Yen	Interest Per cent
270,000	54,000	65	7,347	10
Length of Service Meters	No. of Meters	Gas Manufactured Cub. Meters	Gas Sold Cub. Meters	Coke made Tons
18,949.40	343	185,110	178,061	457

During the following two generations no noticeable progress was made, but after the Chino-Japanese War in 1894-1895, the improved condition of the economic world stimulated the uses of gas, and the increase of its sales. In the year 1893 gas made totalled 1,277,777 cubic meters. In 1896 it had reached 2,552,933 cubic meters.

About the beginning of the twentieth century a further impetus was given, for, after the Russo-Japanese War of 1904-1905 the sudden and intense business activity aroused through all commercial circles resulted in the practical utility of gas for lighting and heating purposes becoming universally recognized. The Tokyo Gas Company shared in the general prosperity, as will be seen from the statistics for the two years 1903 and 1906 :—

Year	Total Capital Yen	Paid up Capital Yen	No. of Shareholders	Fund Yen	Income Yen	Interest Per cent
1903	4,200,000	3,900,000	731	287,035	645,561	14
1906	8,400,000	6,300,000	?	519,052	1,058,495	15
	Service Meters	Gas made Meters	Gas sold C.M.	Coke made Tons		
1903	493,411.82	22,430	12,282,564	11,496,562	26.242	
1906	733,898.49	43,221	20,709,528	19,640,421	43.284	

With the development of the Gas Industry in Japan there came a remarkable development likewise of the electrical industry. This produced of course a great effect on the sale of gas. Gas street lamps reached the maximum number of 824,417 in the year 1914 ; and gas engines reached a maximum horse-power in 1911 of 8,024 derived from 1,045 engines belonging to 904 consumers. But both these figures have gradually decreased year after year. The use of gas for lighting became secondary to its use for heating. Gas for lighting and for gas engines was only employed for emergency uses in the event of break-down in the electric supply. Moreover, during the Great War of 1914 to 1918 the price of coal rose abnormally. The trend of the index number of wholesale prices was distinctly upward.

The gas rate could not keep pace with the rising prices of general commodities, because the gas business was started as a private speculation, and its management was strictly under the supervision of the City Authorities with a compensation clause in operation. A period of depression therefore followed, but, in spite of these adverse conditions, the Company endeavored to sell gas for heating, merely preventing the fall in total volume of output.

In the year 1920 great changes occurred. There was general confusion in business circles ; but as the Gas Industry had already passed through a long period of depression it was little influenced by the universal post-war depression. It even entered on a time of distinct recovery, but received a deeply-felt set-back in the year 1923, caused by the disastrous earthquake in Tokyo and the Yokohama district. Notwithstanding this untoward event The Tokyo Gas Company has shown an upward tendency of development since then, as will be gathered by the figures which follow :—

Year	Total Capital	Paid up Capital	Fund	Income Yen	Dividend Per cent
1922	45,000,000	39,400,000	3,977,170	4,488,107	9
1923	45,000,000	44,966,210	4,370,441	4,156,121	9
1924	45,000,000	45,000,000	4,691,987	5,004,627	9
1925	45,000,000	45,000,000	5,114,919	5,126,360	9



Fig. 3.—Gas Ho'lders (each 142,000 cub.m) at Tokyo Gas Company's Tsurumi Works

Year			Length of Service Meters	No. of Meters	Gas made Cub. Meters	Gas sold Cubic Meters
1922	..	..	2,659,747.65	238,472	178,001,730	155,782,914
1923	..	..	2,683,988.93	142,504	159,196,310	139,042,556
1924	..	..	2,796,890.56	210,248	145,129,520	129,318,562
1925	..	..	2,994,353.65	256,995	189,569,984	182,077,330

After the great earthquake of 1923 the steady increase in population within the city boundaries brought better business, which necessitated important developments. These were completed between 1928 and 1929. Consumers were increased in numbers to nearly 250,000. Consumption and number of consumers continue to steadily increase.

At the end of December, 1933, they totalled 826,200, an increase of 50,380 over the total of the same period of 1932. The position of the Company from the year 1926 to that of 1933 is given in the Table below :—

Year		Total Capital Yen	Paid up Capital Yen	Fund Yen	Income Yen	Dividend Per cent
1926	..	100,000,000	58,750,000	5,180,764	5,478,729	9
1927	..	100,000,000	58,750,000	5,722,266	6,653,950	9
1928	..	100,000,000	88,920,190	6,336,055	8,934,595	9
1929	..	100,000,000	100,000,000	6,962,843	10,126,772	9
1930	..	100,000,000	100,000,000	7,700,899	10,553,468	9
1931	..	100,000,000	100,000,000	6,922,346	9,401,421	8
1932	..	100,000,000	100,000,000	7,592,446	9,297,827	8
1933	..	150,000,000	112,590,900	8,088,755	10,402,605	8

	Length of Services Cub. Meters	No. of Meters	Gas made Cub. Meters	Gas sold Cubic Meters	Coke made Tons
1926	.. 3,027,383.29	291,543	215,433,669	210,173,311	289,812
1927	.. 3,193,312.38	333,877	236,466,640	237,618,258	305,341
1928	.. 4,199,686.20	446,369	279,809,312	270,124,920	346,723
1929	.. 5,174,946.75	694,378	339,283,597	318,354,742	414,663
1930	.. 6,245,193.85	699,123	359,083,759	351,456,472	400,030
1931	.. 6,718,148.35	731,323	412,311,260	386,307,598	439,982
			146,611,960	157,869,391	
			J.T.U.	J.T.U.	
1932	.. 7,183,739.32	775,820	88,386,733	85,185,934.77	383,782
1933	.. 7,417,526.52	826,200	146,263,401	149,842,277.67	423,059

These developments were, at first, principally due to the settlement of coal price questions, and to the introduction of the system of scientific management. On the other hand, the advance of the standard of living, and the increasing cost of competing fuels, assisted the rapid growth of gas output. These circumstances have stimulated the Company to introduce every possible improvement in its business management, as well as in its engineering equipment. The resulting cost of production has by these means been much reduced.

In the second place the developments achieved were due to the fact that the utility of gas for heating, cooking and manufacturing purposes came to be gradually but definitely recognized. It is no exaggeration to say that, to-day, gas is used in practically every activity of the community. As for gas use in other directions, notwithstanding the very substantial industrial load which has been built up by the Company, the peak load occurs at cooking-time, both day and night. The development in the uses of gas for industrial purposes is of recent date: it was given a tremendous fillip during the Great War.

The replacement by gas of solid-fuel-fired furnaces in many instances has led to the lightening of labor, to generally cleaner condition of workshops, to healthier atmosphere for the work people. At the same time it has greatly assisted in speeding-up production. There is also greater accuracy of working adjustment of temperatures, and improved quality of the products. The load for industrial purposes has reached almost 14 per cent of the total output.

Carbonization.—At the end of the year 1933 the Tokyo Gas Company had in operation six manufacturing works. The total daily output was 1,066,000 cubic meters.

Up to the present time nearly all the best types of carbonizing plant have been imported.

They have been carefully studied and continually tested to ascertain which were the best suited to the Company's requirements, and to yield the lowest working costs. Vertical retorts, chamber ovens, and through horizontal retorts worked with mechanical charging and discharging machines, have all been installed from abroad.

Water-gas was adopted in 1902, in order to provide for seasonal changes of gas loads, and also with the object of disposing of coke. The temperature of Japan is very variable during the year; the demand for gas is in inverse proportion to the degree of temperature. The problem is therefore how to attain the highest possible efficiency of the plant in these constantly-altering conditions. It will be appreciated that the water-gas part of the plant plays a very important part in these considerations.

Since the World War the demand for gas has increased to such an extent that the disposal of the by-products has become a most difficult problem in Japan. The Company has in this connection adopted the complete gasification plants of the German Strache, and the Bamag Meguin types. Thus the coke, one of the important items in gas industry management, can be regulated in output according to demand: and it is also of superior quality compared with coke from other systems of carbonization.

Fig. 1 is a reproduction of a photograph of the coke-handling plant at the Tsurumi works of the Tokyo Gas Company.

In the Table below are given figures showing the daily generating capacity of the several types of carbonizing plant installed in the Company's Works.

Works	Capacity per day Cub. Meters	Type of Plant	Number of Furnaces
Shiba	85,000	Glover West Verticals	Two benches
Senjhu	423,000	Glover West Verticals	One bench
		Woodall Duckham Verticals	Two benches
		Horizontals	Two benches
		Bamag Meguin Complete Gasification	Two sets
		Humphreys and Glasgow Water Gas Plant	Four sets
Fukagawa		Koppers Chamber Ovens	Three benches (78 chambers)
		Tokyo Gas Type Complete Gasification	Three sets
Onori	204,000	German Strache Complete Gasification	Two sets
		Humphreys and Glasgow Water Gas	Two sets
		Bamag Meguin Water Gas	Two sets
		Koppers Chamber Ovens	Two benches (40 chambers)
Sunamachi	105,000	United States Gas Improvement Company; Water Gas	Two sets
Tsurumi	249,000	Koppers Chamber Ovens	Two benches (72 chambers)
		Tokyo Gas Type Water Gas	Six sets
Total	1,066,000	Kreisa Complete Gasification	Two sets



Fig. 4.—High Pressure Gas Supply Turbo-Blower at Tokyo Gas Company's Tsurumi Works

Improvements were made in condensers, washers, exhausters, tar extractors, purifiers and meter equipment. Mechanization of plant has been carried out; for instance in the processes of coal conveyance, carriage of boiler fuels, and the transport of ash, etc. These alterations have undoubtedly reduced costs of manufacture.

Fig. 2 is taken from a photograph of a Koppers chamber at the Ohmori works.

At the end of December, 1933, there were sixteen gasholders in the Company's territory. Their aggregate capacity is 1,150,000 cubic meters. Those now in use are chiefly of the water-seal type; but recently, stimulated by the development of the waterless holder in Germany, the Company has imported and erected four of that type in several works. The Table below gives particulars of the sixteen holders in use at the end of 1933 :—

Works	Capacity: Cub. Meters	Type	Number
Shiba	113,000	Water-seal	2
Senjimi	127,000	Water-seal	3
Fukagawa	128,000	Water-seal (1)	2
		Waterless (1)	
Omori	198,000	Water-seal (1)	2
		Waterless (1)	
Sunamachi	74,000	Water seal (1)	2
		Waterless (1)	
Tsurumi	284,000	Water-seal (1)	2
		Waterless (1)	
Yodobashi	56,500	Water seal	1
Takinokawa	85,000	Water seal	1
Meguro	85,000	Water-seal	1
	1,150,500		16

Fig. 3 is from a photograph of the two gasholders at the Tsurumi works: Fig. 4 shows the six high-pressure turbo-blowers at the Tsurumi works.

Distribution.—The gas distribution systems consist of both low pressure and high pressure. Thereby the loads can be adjusted throughout the day and smooth working throughout the area of supply is maintained. Gasholders are erected in every district to receive the high pressure supply. Consumers are supplied either directly from the gasholder or indirectly through the district governors, which are fed by a separate high-pressure gas main containing gas compressed to a maximum of nearly 1 kg. per sq.cm. It is governed down to reinforce the pressure in the ordinary low pressure mains for supply to consumers.

The total length of gas mains and pipes at the end of 1933 was 7,417,526.52 meters.

While great care is taken to maintain all mains and services in a perfect state, some leakage of course is inevitable, due to the need of a gastight joint, and also developments of urban districts. Earthquakes constantly damage the service pipes underground. In the year 1924 the leakage rate was 21.1 per cent. After the great earthquake it went down to 7.3 per cent (year 1933).

By Act of Parliament the gas industry of Japan has to restrict the sulphur content to not more than 5 gm. to each 10 cub. meters, and the ammonia to not more than 2 gm. to each 10 cub. meters. Gas Companies have likewise to declare the minimum calorific value and the pressure of their gas to be supplied. The following are the calorific values and pressures declared by the Tokyo Gas Company, and approved by the Government in April, 1932 :—

Calorific Value	Minimum	4,100 Kg.cal. per 1 cub. meter
	Standard	4,200
Pressure	Minimum	40 mm.

Until the year 1932 the calorific value of gas supplied by the Company was 3,600 kg. cal. per 1 cub.m. on an average. But as the demands for gas increased and the amount set aside for reserve and depreciation grew larger through the continuous success of the Company, the calorific value attained such a high standard simultaneously with the adoption of the thermal system of sale, that the existing equipment may be said to have attained practically maximum efficiency.

Recently the thermal system of sale has been adopted throughout Japan. It was for the first time enforced in the Chiba supply area by the Toho Gas Company, Ltd. In order to rationalize the

selling system of gas as a fuel and to adapt the management to the difficulty of changing the gas rate, the Tokyo Gas Company have also adopted the thermal system of charge. It was introduced by them in April 1932. The present charges for gas are as follow :—

Old Districts of Tokyo City per 100,000 calories	Y.1.99
New Districts of Tokyo City and Tokyo Prefecture per 100,000 calories	2.18
Kanazawa and Saitama Prefectures per 100,000 calories	2.50

The Company have opened ten offices in populous districts, and every office has four or five agencies, totalling 45 altogether. Each office has also a show room in the principal thoroughfares to advertise the advantages of the use of gas.

In order to meet the ever growing demands for gas service the Company has entered into a gas-purchase contract on favorable terms with the Keihin Cokes Company, Ltd., one of its subsidiary companies. The total volume of gas bought under it in the year 1933 was 16,346,022 J.T.U.

Fig. 5 is from a photograph of the show room on the Ginza where are displayed various types of gas ovens, boilers, water heaters and other appliances.

Employees.—The number of employees at the end of 1933 was 4,874 as compared with 4,894 the year before. Since the great expansion of 1928-1929 the Company has been constantly facing the difficulty of having more employees on its books than were needed. At the end of the year 1930, when the number was 5,558, the Company had to limit as much as possible the engagement of new hands; and, also, with the object of reducing numbers, from the year 1932, commenced a new system of retirement by order of seniority, the age limit for the staff being 55 years, and for the workmen 53 years.

It may here be remarked that the Tokyo Gas Company give their employees a greater retiring allowance than do any other Company. By this means happy relationship between employer and employed has been fostered, and general efficiency secured. No strike or other agitation ever occurs.

For the benefit of the employees there has been established a friendly society called the "Kyosaikai." Its objects are to promote a mutual-aid spirit and advance the physical and moral welfare of all employees and their families through the following divisional agencies: (I) Gift Contribution Fund, (II) Mutual Life and Disability Insurance, (III) Health Preservation, (IV) Athletics, (V) Social Betterment of Families, (VI) Amusement and Recreation, (VII) Co-operative Division for Purchase of Daily Necessaries.

Capital and Stock.—The Company has issued no preferential stock. The number and par value of the ordinary shares subscribed for and paid up on December 31, 1933, were as follows :—

Par Value Yen	No. of Shares	Paid up per Share Yen	Total paid up Amount Yen
50.00	2,000,000	50.00	100,000,000
50.00	1,000,000	12.50	12,500,000
	3,000,000		112,500,000

At December 31, 1933, the Company owned the entire capital of the Tokyo Gas By-product Company, Ltd., particulars of which are given below:—

Par Value Yen	No. of Shares	Paid up per Share Yen	Total paid up Amount Yen
50.00	10,000	50.00	500,000
50.00	90,000	42.00	3,780,000
	<u>100,000</u>		<u>4,280,000</u>

The Tokyo Gas By-product Company, Ltd., also owned the entire share capital of Keihin Cokes Company, Ltd., the capital of which at December 31, 1933, was as follows:—

Par Value Yen	No. of Shares	Paid up per Share Yen	Total paid up Amount Yen
50.00	200,000	12.50	1,250,000

The Company also possessed nearly the entire share capital of the Tsurumi Gas Co., Ltd., having a share capital as follows. Only 13 old shares are owned by a shareholder:—

Par Value Yen	No. of Shares	Paid up Share Yen	Total paid up Amount Yen
50.00	9,000	50.00	450,000
50.00	11,000	32.50	357,500
	<u>20,000</u>		<u>807,500</u>

An undertaking for the public benefit with heavy investments in fixed assets and a stable income, as a result of the monopolistic nature of its business and the regulation of its rates, should be able to take full advantage of prevailing money-market conditions. But in this connection the Tokyo Gas Company is not given adaptability of financing, as is the case in other countries. It is due chiefly to the Compensation Contract which the Company has made with the Tokyo City Authorities and to the Regulation Act of the Gas Industry.

Even either the increase of capital or the issue of Bonds are all under the supervision of the City and the Government Authorities. Bank loans and bonds are both limited to one-fourth of paid-up capital.

The Japanese Commercial Law permits the company to issue bonds up to the amount of its paid-up capital. New money for any expansion in the past was nearly always raised by an increase of capital or from bank loans; and it was only twice in 1923 and 1924, after the great earthquake, that bonds were issued.

These financial methods of the past might be steady and definite, but there was no freedom in the raising of money for development work; there was no assistance given to the Company's efforts to reduce costs of manufacture and distribution. During



Fig. 5.—Display Room of the Tokyo Gas Company on the Ginza at Tokyo

the past few years the Company has done its utmost to improve business, to make its financial foundation steady, and to set aside as much as possible for reserve, and to meet depreciation charges.

Since the year 1932 dividends have been cut down from nine per cent, which is the maximum permitted by the Compensation Contract, to eight per cent, and depreciation allowance has every year been set aside at a rate of nearly three per cent of the total of the fixed capital. Funds for reserve have reached almost seven per cent of paid-up capital in 1933. On the other hand the capital was increased from Y.100,000,000 to Y.150,000,000, and paid up to Y.112,000,000. Moreover the Company has obtained sanction for the issue of bonds up to the value of Y.25,000,000.

Such a conservative and constructive financial policy has stood the Company in good stead, and should assist in reducing the cost of capital. At the present time the Company enjoys the advantages of other commercial concerns in financial equipment, and is well prepared for further developments in the future.

From the figures which are given in the following Tables the financial policy of the Company will be made apparent, and the results of that policy understood. They cover a period of five years 1929 to 1933 inclusive, and deal with the General Balance Sheets (assets and liabilities); profit and loss account; and division of profit.

Chinese Wireless Stations

Standard Telephones and Cables, Limited, London, have recently received a large order from the Chinese Government for the supply of wireless stations.

The need of greater communication facilities in China has resulted in the adoption of the present wireless communication scheme. It is intended that the larger towns in China shall each have their own transmitting and receiving stations, in order that they may be in constant communication by telephone or telegraph with the other big centers. These wireless links will take the place of costly toll lines for connecting together the local telephone networks.

From an engineering point of view, the project has many interesting features. It is, on a smaller scale, almost identical with the world telephone services between England, America, Africa, Australia, etc., with which Standard Telephones have been closely associated. The apparatus will be of the most modern design and will incorporate many new features. Very careful precautions have been taken to ensure absolute secrecy on the telephone side, and facilities are provided for high-speed telegraphy.

It is expected that the first part of the scheme will be completed early next year.—*London Times*.

Mercury in Japan

For at least 50 years from now Japan can obtain at home all the mercury she needs without depending on imports. An extensive mercury deposit has been located in the upper reaches of the Teshiogawa in the province of Teshio, Hokkaido.

The discovery was made accidentally by Shigezo Sato, a gold miner, in the fall of 1933, who at once notified the Sapporo mine superintendence bureau.

Following a rough survey by the bureau engineers, Dr. Yoshitaro Kusakabe, lecturer at Waseda University, examined the region for three months in the summer this year, ascertaining that the region contains enough mercury to make Japan independent of importation for at least half a century.

The savant upon his return to Tokyo Thursday night, announced the result of his findings to a gathering at the War Veterans' hall. According to his investigation, the mercury deposit occupies a space of some 90,000,000 cubic feet and is estimated to hold 6,430,000 metric tons of ores.

Supposing the ore to contain one half of one per cent of mercury, it is presumed to hold some 3,000,000 tons of it. Japan at present imports annually 350 metric tons of mercury from Spain or Italy, for which she pays some Y.2,000,000.

Gold in Burma and the Shan States

A Description of the Known Gold Occurrences of Upper Burma and the Shan States

By J. COGGIN BROWN, D.Sc., M.I.M.M., in the "Mining Magazine"

GOLD is widely distributed through parts of Upper Burma and the Federated Shan States. Twenty-seven years ago J. M. MacLaren published a paper* entitled "The Auriferous Deposits of Burma," in which he summarized the information then available. The same author's classical work "Gold, Its Geological Occurrence and Geographical Distribution"

continues the story until 1908. In 1918 T. D. La Touche abstracted the then existing literature very briefly in his "Annotated Index of Indian Minerals of Economic Value" and in 1924 G. de P. Cotter† enumerated the localities where gold had been found up to that time. The Quinquennial Reviews of Mineral Production in India, an official periodical, refer, of course, to the subject, but they are still largely based on MacLaren's work. Two attempts have been made to mine gold-bearing ores—one, successful for a time, ended in 1903; the other, which did not develop beyond the prospecting stage, was abandoned last year. Three attempts have been made to dredge gold-bearing alluvial deposits—in the Irrawaddy, Chindwin, and Namma rivers. The first struggled on for 15 years; in the case of the second the machine was wrecked before it reached its appointed station, and in that of the third infiltration and hardening of the ground quickly stopped operations. To complete this dismal record, though the area referred to is situated in Lower Burma and outside the region under discussion, transport difficulties of heavy dredge parts proved insuperable and they were left strewn along the route to the concession.

The progress of the systematic geological survey and especially the work of Drs. Murray Stuart and H. L. Chhibber have added greatly to earlier know-

ledge. The extension of the settled administration into districts practically ungoverned 20 to 30 years ago and the marked improvement in communications have made various parts of the country much more accessible for prospecting and for capitalistic enterprise. The objects of the present article are to review as concisely as possible the facts available to-day, to interpret them in the light of

the most recent geological results, to announce certain new views on the origin and distribution of the gold and their bearing on economic problems, and, finally, to indicate those portions of the regions concerned which under prevailing conditions appear to merit more intensive examination than they have hitherto received.

THE GOLD-BEARING QUARTZ VEINS OF KATHA.—Lying in the west of the Katha district the Mingin Hills stretch for some 80 miles from north-north-east to south-south-west as the crow flies, attaining their maximum breadth of some 35 miles about Lat. $24^{\circ} 10'$. The highest point in the southern portion of the range—the only part which has even been cursorily examined geologically—is Maingthon Hill, 5,510-ft. above sea-level, though somewhat higher ground exists further north. Almost impenetrable jungle, growing on thick vegetable mould, seriously hampers surface observations.

According to F. Noetling‡ eruptive rocks alone form the hills themselves, the lower ground to the east, south, and west consisting of Miocene beds. Quartz diorite builds the central part of the massif, with numerous dykes of a different composition radiating from it. The outskirts of the hilly tract are

*Min. Journ., lxxxii, 1907, pp. 113-14.

†The Mineral Deposits of Burma, pp. 23-4.

‡Rec. Geol. Surv. Ind., xxvii, 1894, pp. 115-124.



Fig. 1

occupied by a hardened volcanic ash, studded in some places with minute grains of magnetite, pyrite, and pyrrhotite, which carry a trace of gold. Compact and altered agglomerates and fragments of amygdaloidal andesite also occur. Later dykes of two distinct types penetrate the ash beds, the first closely related to the diorite and the second consisting mainly "of felspathic quartz which contains a more or less considerable quantity of auriferous pyrites." Noetling examined five localities all lying within a distance of twelve miles where the outcrops of such pyritic veins had been worked by natives. They are all on the eastern side of the tract, but he made the following significant remark: "I have not the slightest doubt that subsequently they will be found at other places within the ash girdle." The thickest vein, at Taungni, contained little pyrite and yielded 4 dwt. 15 grs. of gold to the ton. The Chouk-paza-taung vein was 9 to 12-in. thick, richer in pyrite and poorer in gold, yielding only 1 dwt. 7 grs. A 4-in. vein at Pinlon was nearly solid pyrite, but only contained a trace of gold. Auriferous pyrite is not confined to the quartz veins, however: more frequently it is dispersed in small crystals through the ash and old diggings proved that the natives had sought for gold in such situations, particularly at Gautama's Hill, north of Wuntho, at Kyaukpyu and Nammaw, in the Pinlebu sub-division, and at numerous other places. Noetling was not impressed by his discoveries. He knew that metallic gold had been won from these outcrops, but he believed that it would be replaced by undecomposed pyrite at shallow depths. To the question Does the pyrite contain a sufficient percentage of gold to make its extraction profitable? he replied with an emphatic negative.

About 1894 C. M. P. Wright opened up shallow Burmese workings at Choukpazat, 26 miles from Wuntho and 11 miles from Nankan railway station, and a small gold mine was soon developed. When G. A. Stonier, a mining specialist of the Government of India, examined the mine in 1900 it was 420-ft. deep.* The vein, averaging about $3\frac{1}{2}$ -ft. thick, had been proved for 240-ft. in strike extension. It carried 14 dwt. of gold to the ton and in places contained so much galena, chalcopryite, and pyrite that it had the appearance of a complex copper ore. The free gold was fine, irregular in occurrence, and most abundant where altaite, the telluride of lead, was present, but it was also frequently associated with chalcopryite. Striking E. 30° N. and dipping S. 30° E. at 62° the vein was cut off on the south-west by intrusive rock, while towards the north-east it gradually thinned out. The rocks of both walls belonged to the volcanic series containing the tuffs and breccias of the district into which the diorite is intrusive. Stonier also described developments on other veins in the neighbourhood, and, after stating that 9 dwt. of the gold content was recovered by amalgamation, concluded with the opinion that free gold would be found at greater depths than the 420-ft. to which this particular vein had then been proved. J. M. Maclaren adds the further information that the vein was occasionally clean, but more often well mineralized, with five per cent of chalcopryite, pyrite, galena, and franklinite, the latter mineral when separated bearing as much as 7 oz. of gold per ton of concentrate, the chalcopryite and pyrite from 2 grs. to 18 dwt., and the galena nothing, while the average amount of gold won per ton crushed over 7 years was 8.3 dwt.† The mining operations were described by A. H. Bromly in 1896‡ and the methods adopted in cyaniding by C.M.P. Wright in 1902.§ The output from the mine increased from 103 oz. in 1895 to 1,934 oz. in 1902, the total recorded yield being 7,742 oz. of gold. In 1903 the pay shoot was lost and further exploration having failed to locate it again the mine was abandoned. The photograph of the Choukpazat mill reproduced in Fig. 2 was kindly lent for the purpose by Mr. Wright.



Fig. 2.—Mill of the Choukpazat Gold Mining Company Ltd.

Until a detailed geological survey of the Katha district has been made it is impossible to guess at the boundaries of the area occupied by these Tertiary volcanic rocks and their associated auriferous veins and sulphides. That it extends much further to the north than the 400 square miles roughly mapped by Noetling is proved by Stonier's discovery of a 9-in. vein containing 9 dwt. of gold per ton of ore at a locality 14 miles north of Banmauk, itself 30 miles north-north-east of Wuntho. It would be remarkable if the vein exploited at Choukpazat eventually proved to be the only one of its kind in an area in which ancient native workings are so widespread. On the other hand it must be remembered that, in the words of Maclaren, andesitic goldfields, as a rule (to which there are, however, several notable exceptions), are characterized by the irregularity of the gold veins both in value and extent, the economic value often depending entirely on very local enrichments.¶ The same authority doubtfully regards the Choukpazat occurrence and the well-known gold mine of Ta-lan (Ta-lang Ting) in Southern Yunnan as the most northerly fields of the great andesitic zone which runs through the East Indian Archipelago developed along meridional lines of Miocene folding, of which the most important goldfields are those of Central and Southern Sumatra.** Some acquaintance with the geology of Yunnan leads the author to conclude that the origin of the Ta-lang deposit is still an open question, but the doubt regarding the Wuntho veins no longer exists. The Tertiary andesitic zone in Upper Burma has also

proved to possess a considerable extension to the north and east and, in the author's opinion, must be held responsible for much of the alluvial gold of certain rivers hitherto regarded as derived solely from ancient crystalline rocks.

GOLD ASSOCIATED WITH DIORITE NEAR KALAW, SOUTHERN SHAN STATES.—In the outer ranges of the Southern Shan States, near the Burma border, on the western slopes close to Mwe-daw ($20^\circ 39' : 96^\circ 28' 30''$) and only some 6 miles south of Kalaw in a straight line, gold has long been known to occur in the surface eluvial deposits. From these and from the beds of small streams in the vicinity it has been washed from time to time by the local tribes-people. Prospecting by Europeans was commenced about 1913, stopped during the War, re-started by a London company in 1932,†† and abandoned in 1934.

The country between Kalaw and Taunggyi, the capital of the Federated Shan States, was geologically surveyed by V. P. Sondhi and the author between 1928 and 1932.‡‡ The rocks at Mwe-daw are limestones and shales of Jurassic age, greatly altered by extensive intrusions of diorite and other igneous rocks, including aplite and biotite-granite. The diorite itself is propylitized and contains visible impregnations of pyrite in many places in spongy crystals and large patches. Widespread silicification has changed the shales into hard flinty rocks, still showing the original bedding planes, while the limestones are either completely silicified and accompanied by much wollastonite or else converted into marble. The gold proved to be very finely divided and erratically distributed in the crushed and re-cemented materials at the contacts, along with secondary silica, hæmatite, and some malachite, according to information courteously placed at the writer's disposal by the Kafue Copper Development Co., Ltd. No vein, lode, or mineralized zone wide enough to warrant mining was apparently discovered.

*Gen. Rep. Geol. Surv. Ind., 1899-1900, 59-63.

†Loc. cit., 265.

‡Trans. Inst. Min. Eng., xii, 506-513.

§Trans. Inst. Min. and Met., xii, 156-9.

¶Loc. cit., 61.

**Loc. cit., 64.

††THE MINING MAGAZINE, XLVII, 1932, 136.

‡‡Rec. Geol. Surv. Ind., lxxvii, 1933-4, 166-248.

The occurrence, though of no economic importance, is interesting in that it furnishes an example of gold deposited at the contact of acid rocks of a granodioritic type intrusive into Mesozoic sediments and thus differs from the gold-bearing telluride and sulphide veins of the Katha district, found in volcanic tuffs and originating probably from late Tertiary magmas of an andesitic character. Whether the two occurrences are coeval manifestations of the same period of igneous activity has still to be determined.

On the edges of the Shan plateau further north, in the valley of the Panlaung River, intrusive igneous rocks of both acidic and intermediate types have been found. It is possible that the source of the dendritic crystals of gold which are believed to come from the hill between the Zawgyi Chaun and the Myitnge River, to the north-east Myogyi ($21^{\circ} 27' : 96^{\circ} 24'$) in the Baw State, is to be looked for in this connexion. The area has still to be geologically surveyed.

GOLD-BEARING ALLUVIAL DEPOSITS OF THE CHINDWIN RIVER.—The Chindwin rises in the Kumon Range about Lat. 26° and Long. 97° and after following a course of some 70 miles to the north-west through the Hukawng Valley, where it is known as the Tanai Hka, changes its direction to the south-west and flowing through Singkaling Hkamti enters the Upper Chindwin district. Thence turning more to the south it traverses the Lower Chindwin district before joining the Irrawaddy near Pakokku. Measured on a map its course is approximately 500 miles long. It is navigable up-stream by small steamers for 300 miles, but Homalin, the upper limit, is not in through communication during the dry season, when navigation finishes at Kindat, 150 miles further south.

Small amounts of gold are found wherever gravels occur in the river. The Chindwin is the Ningthi of the Manipuris and over 100 years ago F. T. Grant published a paper* entitled "Mode of Extracting Gold Dust from the Sand of the Ningthee River, on the Frontier of Manipur." In a second paper also published in the *Journal of the Asiatic Society of Bengal*, in 1834, he stated that all the tributaries entering the river on its eastern bank above Hilao (Helaw, $24^{\circ} 10' 30'' : 94^{\circ} 43'$) carry gold. The lowest point on the main stream, though not on its tributaries, where gold washing is carried on to-day is at Alon ($22^{\circ} 14' : 95^{\circ} 10'$), on the Ye-u branch of the Burma Railways, where villagers occasionally work the recent deposits (Fig. 4). Similar spasmodic operations take place at Kani ($22^{\circ} 27' : 94^{\circ} 53'$), a little further upstream and also in the Lower Chindwin district. Alloys of gold and the platinum metals made in Ava from concentrates collected from streams flowing into the Chindwin from the west near Kani were obtained and assayed more than a century ago by J. Prinsep.†

The gold-bearing deposits were first investigated by J. M. MacLaren, who visited most of the then known auriferous localities in Upper Burma during the open season of 1905-6. His report was a confidential one for the Government of India, but some details are given in the article referred to earlier. The late H. S. Bion examined them again in 1912-13 and his report is available in the 43rd volume of the *Records of the Geological Survey of India* (pp. 240-263). The assays which accompany this were carried out under the writer's own supervision. The geological survey of the northern part of the Lower Chindwin district and adjoining tracts in the Upper Chindwin and Shwebo during the

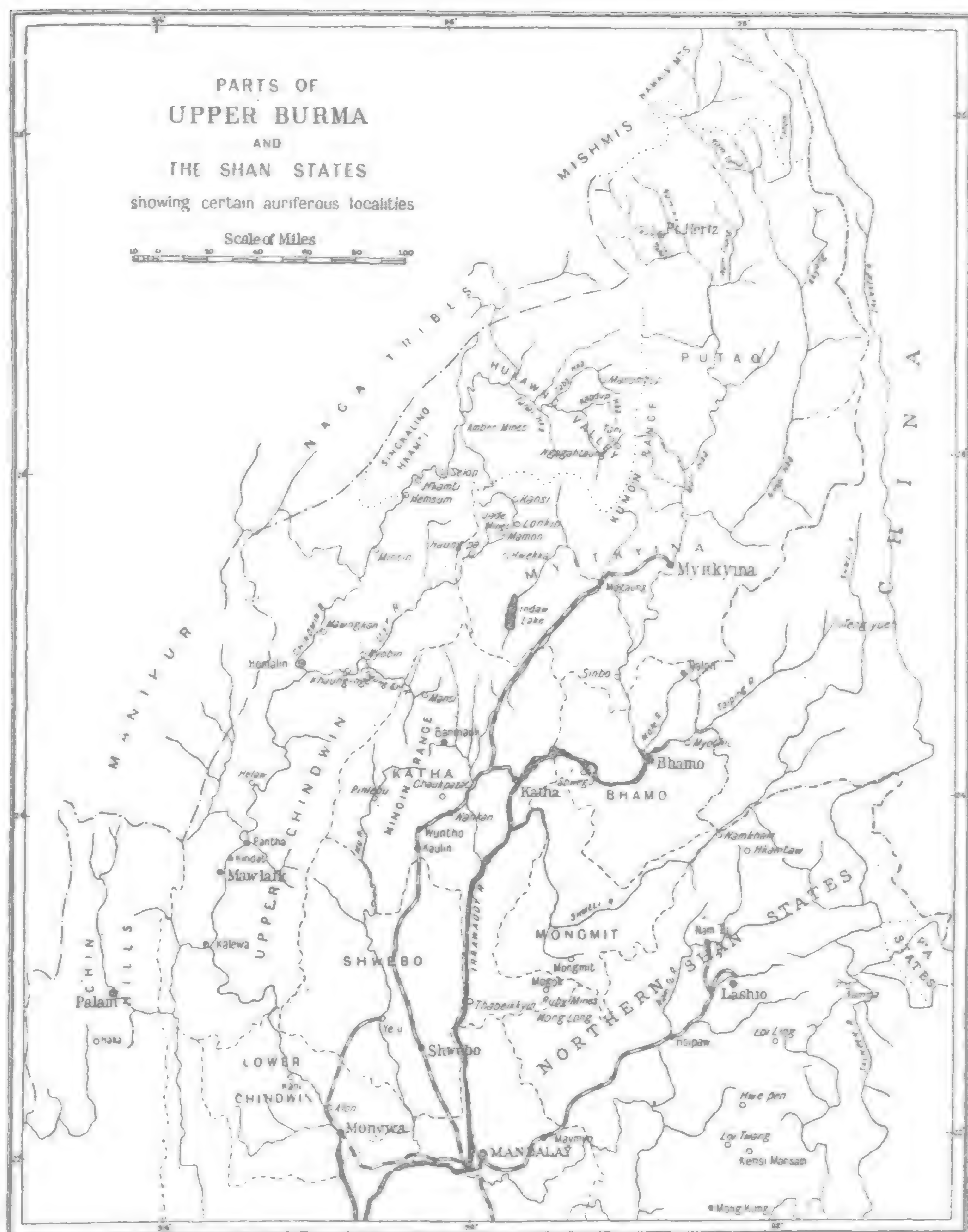


Fig. 3

years 1927-1930 disclosed some 25 new localities where gold washing is practised by the Burmese, usually after heavy rains, in tributary streams away from the main river. They all lie between Lats. $22^{\circ} 10'$ and $22^{\circ} 50'$ and Longs. $94^{\circ} 30'$ and 95° approximately and are of no particular economic importance with the possible exception of those of the tributaries of the Paukin Chaung, where the native industry has been long established. They definitely proved, however—what had previously been suspected—that the gold is derived from the Irrawaddy sandstones, a great series of continental deposits of Mio-Pliocene age which covers a vast area in Burma.

In addition to the recent gravel and sand banks under formation in the river to-day the Chindwin valley, in common with those of most other big rivers in Burma and adjoining countries, contains older gravel terraces of Pleistocene age which mark the positions attained by the valley floor at periods of comparative freedom from upward crustal movements during the earlier stages of its development. They are well exposed along the whole course of the river at numerous points between Kindat and the northernmost limit of Singkaling Hkamti. They form benches, of coarse, well-rounded pebbles of small dimensions, of quartzite, schist, and

**Journ. A.S.B.*, i, 1832, 149.†*Journ. A.S.B.*, i, 1832, 14-17.

phyllite, and, above Homalin, of serpentine, set in a ferruginous matrix which makes up but a small percentage of the bulk and is derived mainly from the soft underlying Tertiary sandstones. These older gravels everywhere contain small amounts of gold and platinum and the precious metal contents of the recent river deposits are undoubtedly derived from their degradation. In both older and recent deposits the gold is in thin laminæ and scales, the majority being $\frac{1}{20}$ -in. in length, but a considerable proportion occurs in fine specks and "float" gold is always present. Platinum in small quantities has been detected in almost every locality, together with the rarer metals of the same group. The bulk of the heavy residue is composed of magnetite, but zircon and garnet are also common.

Recent gravels are worked by villagers in the upper waters of a small stream flowing into the river on the left bank, 7 miles below Kalewa, and further up stream at Maulaigy, 6 miles below Kindat. Continuing north, the recent deposits at the heads of the two small islands of Helaw and Gyogon ($24^{\circ} 10' 30'' : 94^{\circ} 43'$) and on a small beach on the right bank at Ywatha, in the same vicinity, attract more attention from the native washers, but the gravel is only a surface deposit of no great thickness in which the gold is trapped and seems to be renewed during the annual floods. Maclaren believed that the only possible hope of success in dredging here lies in scraping up a surface layer of 8-in. to a foot, an operation that means a great reduction in the lifting capacity of a dredge, since the buckets will rarely fill. Bion's more exhaustive tests showed that even in the surface layer the gold content was not constant and might be absent altogether, being only rich at points which marked the heads of the islands at successive stages in their emergence after the monsoon. He held out no hope of successful dredging.

Between Helaw and Homalin the river deposits are mainly sand and tests which have been made on such small patches of gravel as do exist have given very poor results. Above Homalin there are gravel beaches at Pinpanu and Pebin, opposite Maungkhan, at Limpa ($25^{\circ} 52' : 95^{\circ} 40'$), at Hemsun, and at Pawmang, $\frac{1}{2}$ mile below Hkhamti. At Maubin there are two beaches and similar occurrences are found still further north at Labaingaik and at Selon. Here the river enters a gorge in schistose rocks before making its right-angled bend into the Hukawng Valley. Such panning tests as Bion made on these beaches gave uniformly low values. His results on the older gravels were very little better and he remarked that they were far too poor to be worked even by the native washer.

Summing up all the available evidence, it appears that until it crosses the 96th parallel of longitude and enters its gorge near Selon, the Chindwin flows over Tertiary rocks and consequently the possibility of richer placers existing in the northern portion of this part of its valley becomes remote; that the gold in both Pleistocene terraces and recent beaches is derived from the Irrawaddy sandstones, with the exception of that entering from the Uyu, a large tributary on the eastern bank, which joins the parent stream at Homalin, and that the platinoid metals probably come from the great belt of serpentine which has the usual mineral associates and which stretches through the Arakan Yoma, Manipur, the Naga Hills, and across the Chindwin gorge to link up with similar occurrences in Myitkyina district. Thus, although alluvial gold is found from one end of the Chindwin to the other, its secondary derivation, its physical constitution, and its scattering by the great seasonal floods of the river have together resulted in so wide a distribution that its concentration in any particular place, so far as is known at present, is quite insufficient to justify the advocacy of dredging operations.

A concession was granted years ago to the Mandalay Gold Dredging Company over 180 miles of the river between Homalin and Minsin, but the dredger was stranded while being towed upstream.

GOLD-BEARING TERRACES OF THE UYU RIVER.—The Uyu rises in the Mogaung subdivision of Myitkyina district and flowing to the south-west and west enters the Chindwin near Homalin. As in the case of the latter gold occurs in both recent and high level older gravels. The latter in places attain thicknesses of over 150-ft., are much finer in texture than those of the Chindwin and consist of lenticles of gravel and sand. At Kyobin ($24^{\circ} 50' : 95^{\circ} 20'$), a well-known gold-bearing locality, they contain many pebbles of igneous rocks that have travelled down the Chaunggyi Chaung from the northern extension of the volcanic massif of the Mingin Hills, in which this tributary of the Uyu itself rises.

Khaung-ngo ($24^{\circ} 48' : 95^{\circ} 14'$) is the only locality in the Lower Uyu Valley, according to Bion, where the recent deposits are washed for gold. His tests here showed that the native workers

recovered about 2 grains per cubic yard. At Kyobin ($24^{\circ} 50' : 95^{\circ} 20'$) ground sluicing in the older terrace deposits has been carried on by Shans for many years. Their main workings at the time of Bion's visit laid to the east and north-east of the village, scattered over an area of less than one square mile, though there were then further workings at Teingon, on the opposite bank of the river, and at other places. False-bedded gravels and sands form a terrace, averaging 50-ft. in height and standing back $\frac{1}{2}$ to $\frac{3}{4}$ mile from the Uyu itself. The gravels are exceptionally fine, the majority of the pebbles being from 1 to $1\frac{1}{2}$ -in. in length. Small lenticles of clay occur in places, but would cause no trouble in large-scale operations. Bed-rock is nowhere exposed and Bion did not reach it in any of his pits. The deposits are at least 90-ft. thick and in places probably attain 150-ft.

At first sight the results of Bion's tests appear poor, but an analysis of them reveals some interesting features. Thus the mass average content of the gravels and sands from four pits at the Hwe Zadaik workings is only 0.69 grs. per cubic yard, but the greater part of this is from upper material which the native washers do not touch. In the bottom 7 ft. of a pit 25 $\frac{1}{2}$ -ft. deep, which met the lowest horizon reached here, a value of 2.56 grs. per cubic yard was returned and this particular band was not completely intersected elsewhere. In the case of the Hwe Mamon workings the mass average of three pits is 2 grs. per cubic yard and here again

the low values are towards the surface. In one pit 29-ft. 9-in. deep the bottom 7-ft. 3-in. contained 5.7 grs. per cubic yard. Another, sunk at the horizon of this richer band, only displayed 2 $\frac{1}{2}$ -ft. of gravel with 2.32 grs. per cubic yard when it was stopped by water, while a cut made at the exposed base of the cliff yielded 2.68 grs. Other examples might be quoted showing the same tendencies, but full details of all the pits are given in the publication already referred to. Experimenting with the local labour Bion concluded that the Shan washers recovered from 3 to 4 annas' worth of gold per day, working only from three to four hours, and from the author's own experience of their methods he has no doubt that they lost much of the fine gold and threw away any platinum met with.

Maclaren pointed out* that the Kyobin deposits had attracted the attention of prospectors, but since no serious work had been done on them they were presumably too low in value to return interest on the capital necessary for their development. Without



Fig. 4.—Native gold washer, Chindwin River

**Loc. cit.*, p. 208.

this serious work, however, it is impossible to form a correct opinion. Bion believed that the payable gravel at Kyobin is so intimately mixed with barren sand and so inconstant in character that both would have to be treated together, while the mass average value is far too low to enable work to be carried out at a profit. At the same time he enumerated various initial difficulties which dredging would encounter. The writer's own opinion is that the question is still an open one until the gravels have been more systematically examined and their gold content more accurately estimated. Bion did the utmost possible in the time and with the means at his disposal, but thick, erratic, false-bedded river deposits of this type need unusually close pitting or drilling and bedrock must be reached before they are finally condemned as unlikely to be profitable under existing conditions. Again, between the terraces and the river there are stretches of swampy ground, the surface of which is clay with gravel occurring below it, probably a rewash of the high-level material, which may well be richer than the terraces but being thoroughly waterlogged does not appear to have been tested.

Any methodical investigation of the Kyobin gravels should be extended to the southeast up the valley of the Chaunggyi Chaung and into the foot-hills of the Mingin Range. Gold washing is practised along this stream and gravels are known to occur at various localities—as, for example, at Mansi—as far as its headwaters in the Katha district. They lie, of course, progressively nearer the source from which some of the gold in the Uyu itself has been derived, but they have not been the subject of official inquiry. "The higher reaches of the Uyu, as far as Haungpa," wrote Maclaren, "have also been prospected, but with little success," but this portion of the valley was not visited either by Maclaren or Bion. At about Long. 96°, and just before Haung-pa is reached, the river enters the Jade Mines Tract of the Myitkyina district and for our knowledge of the gold occurrences therein we depend mainly on the work of Dr. H. L. Chhibber, who, as a member of the Burma Party of the Geological Survey of India, of which the writer was then in charge, surveyed the region during the seasons 1928-1931. The names of the localities where Chhibber found gold washing practised in and about the Uyu and its tributaries have been published in various annual reports of the Geological Survey of India. They are collected and rearranged below in ascending order upstream:

- (1) Nam-sa-bein, near Haung-pa (25° 30' : 96° 6' 15").
- (2) Along the existing bed of the Uyu between Pantin, which lies on the left bank at the confluence with the Mawmoan Chaung, and at Mamon (25° 35' 10" : 96° 15' 57").
- (3) Parpyin (25° 35' 21" : 96° 16' 40").
- (4) Anma, 5 furlongs east of Hpakan (25° 36' 38" : 96° 18' 40").
- (5) The island in the Uyu River, opposite the village of Lasa (25° 38' 57" : 96° 21' 26").
- (6) Lonkin (25° 39' : 96° 22').
- (7) The Mawsisa Chaung, the first important stream crossed between Lonkin and Hpakan (25° 36' 38" : 96° 18' 40").

(Fig. 5 shows women panning in the bed of the Upper Uyu, Myitkyina district.)

In this portion of the valley the old river terraces already described are replaced by a



Fig. 5.—Upper Uyu, near Tawmaw, Jade Mines tract, Myitkyina district

orite. Chromite, hæmatite, limonite, and jadeite are also found in the same boulder form. Indeed, the conglomerate has been and is pitted on a very extensive scale and in a most primitive fashion by Chinese and Kachins for the jadeite which it contains and which has been derived from the dykes of this mineral found in the region, particularly around Lonkin (25° 39' : 96° 22'), Kansi (25° 47' : 96° 22' 48"), and Hwehka (25° 29' : 96° 17'). Almost the whole of the ground occupied by those of the formation which are jadeite-bearing has been dug over and ancient pits are numbered by the thousand.

The sands from the lower beds of the conglomerate are washed by Shan women who, according to Chhibber, can collect as a rule 6 to 7 annas' worth of gold in a morning's work. During 1914-15 an attempt was made by an ex-American missionary who had turned gold miner to win alluvial gold on a commercial scale at Mamon. About 100 oz., together with some platinum, are reported to have been obtained before the experiment was abandoned. H.D. Griffiths states that in the small valleys and creeks, tributaries of the Uyu, he found gold, invariably associated with platinum, in all parts of the conglomerate while many cross-sections which he tested gave an average of 3 to 6 grains per cubic yard though the fine gold was not recovered.* Griffiths only explored a small part of the area, but saw sufficient to convince him that further systematic exploration would reveal many places worth exploiting, although he does not minimize the trouble likely to be caused by difficulties of communication in the rainy season and by endemic malaria. He expressed the hope that the detailed geological survey would later give the same indications of gold deposits as it had done in the case of the tin and wolfram deposits of Lower Burma. The Geological Survey has now mapped the Uyu Boulder Conglomerates and whether they are rich enough to warrant hydraulic treatment in some form or other is for private enterprise to decide. The Survey has done more than this, for Dr. Chhibber's work has shown that in addition to the peridotites, serpentines, and their valuable jadeite dykes there exists in this part of the Myitkyina district a great series of volcanic agglomerates, tuffs, breccias, and andesites of late Tertiary age. Mount Loimye, 5,124-

ft. above sea-level and a very conspicuous landmark, proves to be a breccia and lava dome, somewhat higher than Mount Popa, the well-known extinct volcano of Central Burma. This is a result of important economic significance, for on the analogy of the occurrences in the Mingin Hills already described the author seeks the origin of the greater part of the gold in the alluvial deposits of the Uyu



Fig. 6.—Confluence of the Mali Hka (left) and the 'Nmai Hka (right), the commencement of the Irrawaddy

*THE MINING MAGAZINE, XXV. p. 343.

valley and in the upper reaches of the Chindwin itself, in the Hukawng Valley, in these rocks rather than in the older crystalline strata which also occur.

GOLD OCCURRENCES OF THE HUKAWNG VALLEY.—The Hukawng Valley is a large alluvial plain surrounded by mountain ranges, which follow a more or less elliptical course around its borders, lying north of the Jade Mines area and to the north-west of Myitkyina itself. Its main stream is the Tanai Hka, the north-westerly flowing upper portion of the Chindwin. Both it and its tributaries meander sluggishly across the plain and it is in the affluents from the enclosing mountains that gold-bearing deposits have been found. The valley is extremely secluded, unadministered, and seldom visited by Europeans. Captain Hannay, who reached the amber mines of the Hukawng from Ava in 1836, enumerates* gold, both in the form of dust and in pieces the size of a large pea, as products of the valley. The streams in which it was most plentiful are the Kapdup and Nam Kwan, where pitting of the older alluvial deposits was carried on. Noetling, who visited the amber mines with a military expedition in 1891, and Dr. Murray Stuart, who traversed the valley with an exploratory railway survey party in 1920, are both silent on the subject. Mr. W. A. Hertz, the greatest authority on the frontier regions of Burma, informs the author that the best streams in the Hukawng for gold are the Tawa, Namkwan, and Kabdup, in the mountainous portions of their courses, but that gold washing has been stopped in the last-named because the local augurs have declared that the earth spirits do not approve it. It was not until 1930 that another opportunity occurred for a somewhat fuller geological reconnaissance, when Dr. Chhibber was deputed to accompany the Hukawng Valley Expedition between March and May of that year. He found that the Boulder Conglomerate of the Uyu Valley is here represented by a closely similar deposit, to which he gave the name of the Tanai Hka Boulder Conglomerate. In the eastern portion of the valley it was found between Kaidu Ga ($26^{\circ} 14' : 96^{\circ} 59'$) and Warang ($26^{\circ} 11' : 96^{\circ} 58'$) and has been traced as far as Ngagahtawng ($26^{\circ} 11' : 97^{\circ} 3'$), where its sandy intercalations are washed for gold. It consists mainly of disintegrated boulders of quartz-, mica-, and graphite-schists, embedded in reddish or yellowish soil. Altered peridotites and serpentines occur on the western limits of the valley, but of greatest significance in our present inquiry is the discovery of the presence of volcanic breccias, tuffs, and consolidated ashes of Tertiary age. The more important localities where gold is won from the recent alluvial deposits of the Tanai Hka (Chindwin) and its tributaries are the following, according to Chhibber's contribution to the annual report of the Geological Survey of India for 1930†:

- (1) Mashe Daru ($26^{\circ} 24' : 96^{\circ} 36'$), on the right bank of the main stream.
- (2) The Tabyi Hka ($26^{\circ} 30' : 96^{\circ} 53'$). The sands of this stream are locally reported to be very rich and washing is carried on wherever alluvial deposits have accumulated. Small nuggets are occasionally found in addition to the usual fine dust gold.
- (3) Masumzup ($26^{\circ} 31' : 96^{\circ} 59'$). This place is about 1 mile 5 furlongs from the con-



Fig. 7.—The 'Nmai Hka, Putao district

fluence of the Sumting Hka and the Tabyi Hka (No. 2, above). According to the local washers they are richer still.

- (4) The upper reaches of the Nambyu Hka.
- (5) The Kapdup Hka, close to and above the village of 'Nbawn ($26^{\circ} 21' : 96^{\circ} 59'$). At one locality, on the left bank of this stream, there are numerous deserted pits which are related to have been made during the times of the Burmese kings.

The Hukawng Valley was one of the last places in the Empire where slavery lingered until modern times and large numbers of slaves were employed in these gold washings, but since their liberation and partial migration to more settled areas (one of the results of the expedition which Dr. Chhibber accompanied) the industry has dwindled. He gives the amount of gold won in the various workings as varying from a minimum of four annas' weight per man per week to the high recovery obtained at Masumzup, where during a week of heavy rainfall it is stated to reach one rupee's weight

of gold. Expressed in grains per man per day these quantities represent $7\frac{1}{2}$ and 30 grs. respectively.

Workings for gold also exist in the Tanai Hka Boulder Conglomerate, as, for example, in the area enclosed by the V-shaped bend of the Namgawn Hka ($26^{\circ} 18' : 96^{\circ} 29'$), where old pits descend to a depth of 30-ft., beyond which the ground is waterlogged. In these a lateritized overburden from 3 to 10-ft. thick is followed by the conglomerate with boulders of quartz and siliceous and volcanic rocks, the latter being considered a favourable sign for the occurrence of gold. The bottom layer exposed consists of sand or of fine pebbly conglomerate. Two men generally work together in these diggings, the best yields, according to local information, being about $1\frac{1}{2}$ tolas in 6 days and the minimum from 8 to 12 annas' weight of gold for the same period. These quantities are equivalent to $22\frac{1}{2}$ grs. per man per day in the first case and to $7\frac{1}{2}$ and $11\frac{1}{4}$ grs. in the second.

Many old workings occur under much the same conditions about the Lungkrut Hka, to the west of Tari ($29^{\circ} 12' : 97^{\circ} 2'$), and extend to the headwaters of the stream. Here the pits are only 6-ft. deep and the sand in which the boulders occur is washed. Two men operating together for ten days accumulated about 4 annas' weight of gold, or at the rate of $2\frac{1}{4}$ grs. per man per day.

The old workings in the valley of the small stream which joins the Tanai Hka a little to the west of Ngagahtawng ($26^{\circ} 11' : 97^{\circ} 3'$) are in the form of trenches to permit of the easier removal of big boulders. The interbedded sand-rock, of a reddish or darkish colour, varies from a few inches to a foot in thickness, rich patches of which, according to local reports, might yield as much as 45 grains of gold per day, presumably to two workmen. A consideration of the new evidence collected by Dr. Chhibber has led the author to the following conclusions:

- (1) All the localities mentioned are to the east of the Tanai Hka and mainly in the tributaries flowing from the Kumon Range.

(To be Continued)



Fig. 8.—The Mali Hka, Putao district

*Journ. A.S.B., vi, p. 60.

†Rec. Geol. Surv. Ind., lxx, 1931, pp. 48-50.

Chinese Purchases in Britain*

THE annual meeting of the Chinese Government Purchasing Commission was held in London, in February, when the report for 1934 was adopted.

It shows that since the Commission came into existence it has spent in Great Britain over £2,915,000 on railway and other material. Further orders to the value of £200,000 were decided on at the annual meeting.

Administrative expenses are remarkably low. They amounted last year to £6,470, which is only .44 per cent of the year's expenditure on materials, freight, etc.

The Chinese Minister presided at the meeting, Dr. C. C. Wang, the Director, who has been ill with influenza, was warmly welcomed back. There were also present Sir Ralph Wedgwood, Sir Basil Blackett and Sir Arthur Balfour.

The statement showing the Commission's financial standing, and the report, in full, are as follows.

Finances

The total funds held by the Commission on December 31, 1934, amounted £2,184,856 3s. 5d., of which £1,534,521 4s. 0d., was in current accounts and bank deposits and £650,334 19s. 5d., in securities at cost.

The Income derived during the year under review from interest on Bank Deposits, current accounts and dividends from Securities, amounts to £54,378 15s. 5d.

The result of the Commission's investment operations is as follows:—

(1) The book appreciation of the securities held at December 31, 1934 was £52,715 0s. 7d.

(2) The Capital Profit realized from the sale of securities during the year ending December 31, 1934, was £73,644 10s. 7d.

(3) The Capital Profit realized from the sale of securities from the beginning of operations to December 31, 1933, was £52,919 2s. 11d.

Thus (2) plus (3) equals total capital profit actually realized up to the end of 1934, namely £126,563 13s. 6d.

Regular payments on account of Indemnity Fund Instalments have been received during the year.

The present report covers the period from January 1, 1934, to December 31, 1934.

No change has taken place in the membership of the Commission during the year under review.

The term of office of the members of the Commission expired in May, 1934. By decree of the Executive Yuan of the National Government of the Republic of China the members of the Commission were reappointed for a further term of three years, i.e. until May, 1937.

The third Annual Meeting of the Commission was held on April 18, 1934. The following is an extract from the records of the meeting:—

"Before the business on the agenda was taken, the Chairman read the following telegram from the Board of Trustees for the Administration of the Indemnity Funds remitted by the British Government:—

"The Executive Yuan, at its meeting held on March 27, passed a resolution to the effect that all members of the Chinese Government Purchasing Commission be reappointed to another term of office. The Board highly appreciate the past services of the Commission and confidently believe that the future services of the Commission will be equally successful and satisfactory."

The Chairman stated that the Chinese Government had reappointed all the members of the Chinese Government Purchasing Commission for another term and wishes to express the confidence which has been inspired by each individual member of the Commission, also the high appreciation of the services rendered by the Commission as a whole and by individual members.

The Chairman said: "I need hardly add to the expressions of appreciation which the Chinese Government feels towards the members who have given much of their time and thought in order to make this Commission a success and I am sure we all look forward to another three years of very useful and satisfactory service and close co-operation between the Commission and the Board of Trustees."

Sir Ralph Wedgwood replied on behalf of the members: "We would like to thank your Excellency very warmly for your cordial sentiments and wish to ask your Excellency to convey to the Chinese Government our thanks for their appreciation of the services we have been able to render. It has given each and every one of us much pleasure to work with your Excellency for a common purpose."

The Committees

Sir Ralph Wedgwood and Sir Basil Blackett were re-elected Vice-Chairman and Treasurer, respectively, and the following committees were re-elected:

Committee on Consulting Engineers, Chairman: Sir Ralph Wedgwood, Members: Sir Arthur Balfour, Dr. C. C. Wang.

Finance Committee:—Chairman: Sir Basil Blackett. Members: Mr. G. A. McEwen, Dr. C. C. Wang.

During the year the Commission met on eight occasions; the Committee on Consulting Engineers met six times and the Finance Committee four times.

In addition to the work of the Commission which has been conducted at meetings, the members have been freely consulted by correspondence, and also personally, in order to enable the execution of indents and financial matters to be dealt with promptly and to the best advantage of the organizations concerned. Decisions made by Committees or in consultation are in every case subjected to confirmation at the subsequent meeting of the Commission.

Board of Trustees

It is believed that the procedure adopted for purposes of co-operation with the Board of Trustees is operating satisfactorily.

A matter outside the official functions of the Commission was raised by a request from the Board of Trustees for advice and assistance in connection with the issue of a loan of £1,500,000, secured upon the half of the indemnity instalments which are payable in China, in connection with the construction of the Canton-Hankow Railway.

The following reply was dispatched on March 28, 1934:

"Referring to your telegram the Commission feels it cannot offer official suggestions and that it is precluded from itself investing in the loan. Following points, however, emerged at a recent informal finance meeting. First: better price might be secured by offering loan in two or three separate series, presumably the whole £1,500,000, not wanted at once. Secondly: it is believed that British Treasury agreement not to object to issue of sterling loan in Shanghai was given on implied understanding that facilities would not be given for subscription to be invited in London. This does not, however, preclude Chinese Government from enlisting support of British firms represented in China such as oil companies, cable companies, etc. There is reason to believe that substantial subscriptions would result and this would improve price. Well secured 6 per cent loan has great attractions for companies and persons looking for suitable investments."

Staff

The office staff of the Commission was increased by the engagement of one additional clerk in the course of the year, and now consists of: Director, Secretary, Chinese Assistant, Accountant, Book-keeper, Shorthand-typist and General Clerk.

The work of the Commission, which greatly increased in volume throughout the year, has been carried out satisfactorily by all concerned.

Messrs. Price Waterhouse & Company continue to audit the accounts of the Commission.

Consulting Engineers

Messrs. Sandberg and Messrs. Fox and Mayo continue to act as consulting engineers to the Commission.

*North-China Daily News.

The services of Sir Alexander Gibb & Partners have also been engaged, in connection with additional indents for spares for the Nanking-Pukow Train Ferry Bridges, and indents for sluice gates and culverts for the Kuangtung Conservancy Commission.

Sir J. H. Biles & Company have performed the duties of Naval Architects in connection with the indent for coasting steamers for the China Merchants' Steam Navigation Co.

Messrs. Killick Martin & Co. and Messrs. L. Hammond & Co. have continued to act for the Commission as Shipping Agents and Insurance Brokers, respectively.

The Commission has pleasure in reporting that the services of its consulting engineers, auditors and other agents have been entirely satisfactory.

Purchases

The number of indents received during the year shows a substantial increase as compared with previous years.

A large proportion of the purchases have been made on account of the Canton-Hankow Railway, the completion of which may be regarded as the most important purpose to which the materials purchased with the aid of the Indemnity Funds are being applied, as it will provide a link between the North and South of China.

The wireless station purchased by the Commission in 1933 for the Ministry of Communications was put into service on February 3, 1934, giving direct communication between Shanghai and London and also between Shanghai and San Francisco.

Other important schemes for which materials have been purchased during the year are :

- (a) Four 3,400 ton Coasting Steamers for the China Merchants' Steam Navigation Co. These vessels were built in pairs on the Clyde and the Tyne, respectively, and have been safely delivered in China.
- (b) Radio telegraph and telephone equipment for the Ministry of Communications for both internal and international services.
- (c) The Kiangsu and Nine Province Toll Line Telephone scheme for the Ministry of Communications.

The value of contracts placed and the amounts paid thereon are as follows :—

Period from the Institution of the Commission to	Contracts Placed		Amount paid on Contracts, including Freight, Insurance and Inspection Fees	
	No.	Value		
31/12 33	230	£1,065,045 14	1	£1,039,162 9 7
Year 1934	245	£1,849,979 17	9	£1,471,767 19 3
Total	475	£2,915,025 11 10	10	£2,510,930 8 10

Of the contracts placed in 1934, 57 were under £100, in value ; 90 under £1,000 and 98 over £1,000.

The total expenditure since the Commission commenced to operate is £2,533,251-16s. 1d. This figure includes the Commission's administrative expenses, which in 1934 amounted to £6,470 11s. 6d. or .44 % of the year's expenditure on materials, freight, insurance and inspection fees.

The total tonnage shipped under f.o.b. contracts during the year was approximately 89,437 tons.

The most important contracts placed during the year were in round figures :

40 ton Steel Flat Wagons	£9,000	for the Ministry of Railways (Canton-Hankow Railway)
Rails and Fastenings	£98,000	" "
Power Plant	£10,000	" "
Machine Shop Buildings and Cranes ..	£30,000	" "
40 ton Steel Flat Covered and high-sided open Wagons	£81,000	" "
Rails and Fastenings	£280,000	" "
Water Tanks and Pumps	£10,000	" "
Drills and Air Compressors	£7,000	" "
Bridgework	£21,000	" "
40 ton Steel Covered and high-sided Wagons	£17,000	" "
0-8-0 Type Shunting Locomotives ..	£24,000	" "
III Class Sleeping Cars	£62,000	" "
Bridgework	£40,000	" "
Reinforcing Bars	£26,000	" "
4-8-4 Type Locomotives	£113,000	" "
4-8-4 Type Locomotives	£68,000	for the Ministry of Railways (Shanghai-Hangchow-Ningpo Rly.)
Rails and Fastenings	£70,000	for the Ministry of Railways (Kiaochow-Tsinan Railway)
2-8-2 Type Locomotives	£40,000	" "
Carriage Underframes	£4,000	" "
Bridgework (Steel plates, bars and sections)	£76,000	for the Ministry of Railways (Peiping-Liaoning Railway)
Rails and Fastenings	£27,000	" "
Bridgework	£16,000	" "
15 ton Steel Covered Bogie Wagons ..	£8,000	for the Hangchow-Kiangshan Rly.
Passenger Car Underframes	£7,500	" "
4-8-0 Type Locomotives	£20,000	" "
Radio Telephone Link Equipment ..	£48,000	for the Ministry of Communications
Telephone Wire	£82,000	" "
Insulators and Spindles	£27,000	" "
Telephone Equipment	£57,000	" "
Coasting Steamers	£340,000	for the China Merchants' S.N. Co.
Lock Gates	£15,000	for the Huai River Commission
Steel Piling and Reinforcing Bars ..	£29,000	" "
0-8-0 Type side tank Locomotives ..	£5,000	for the Ministry of Railways (Nanking-Pukow Train Ferry)

A statement of the Purchase Orders received and executed by the Commission up to the end of 1934 is appended to this report.

Finance

The total funds held by the Commission on December 31, 1934, amounted to £2,184,856 3s. 5d.

The income derived from interest on bank deposits, current account and dividends from investments, together with £73,644-10s. 7d. profits realized on investments sold during 1934 amounts to £128,023 6s. 0d.

Investments held by the Commission at December 31, 1934, amount to, at cost, £650,334 19s. 5d. The book appreciation at December 31, 1934, was £52,715 0s. 7d.

Regular payments on account of Indemnity Fund instalments have been received during the year.

Students

The work of arranging facilities for the practical training of Chinese students and junior engineers with British firms is being continued.

Opportunities of gaining training or experience have been so far arranged for 40 students in the following industries, etc.

Railway	7
Locomotive Works	8
Bridge, machine tool and other works ..	11
Electrical, Wireless and Cable Works ..	12
Shipbuilding	2
Aircraft	1
Port and Harbor Board	1

The Commission desires to express appreciation of the assistance given by all who have co-operated in connection with this work.

Motor Vehicle Production in Japan

The first authoritative statement relating to the production of motor vehicles and parts in Japan, and figures concerning automobile imports into Japan, was issued at the end of April, 1934, by the Japanese Consulate, Cape Town, and is summarized as follows :—

To end of August, 1932, approximately 80,000 motor vehicles (exclusive of motor cycles) were licensed, of which about 2,000 were completely constructed in Japanese factories ; practically all imports came from America. To encourage local production, on recommendation from an enquiry commission in May, 1930, subsidies were granted to truck and bus factories, since extended to car factories. Since then cars with engines not exceeding 750 c.c. capacity have freedom of use without Imperial or local taxation.

At present, April, 1934, there are seven factories. Ishikawajima Automobile Manufacturing Co., Ltd., Tokyo, making six-cylinder trucks up to two tons load, trade name "Sumida." Tokyo Gas and Electrical Industrial Co., Ltd., Tokyo, six-cylinder cars and trucks, latter up to two ton load, trade name "Chiyoda"; Dat Motor Car Co., Ltd., Osaka, six-cylinder buses and trucks, mainly for military purposes, also four-cylinder 750 c.c. baby cars, trade name "Dat." These three companies are to be amalgamated to reduce costs by mass production.

Mitsubishi Shipbuilding and Engineering Co., Ltd., Kobe, building since 1918 six-cylinder high-power buses, carrying forty or more passengers, trade name "Fuso." Japan Carriage Co., Ltd., making eight-cylinder expensive cars, trade name "Atsuta." Kawasaki Dockyard Co., Ltd., Kobe, making six-cylinder cars in medium-price class, trade name "Rokko"; factory now re-organizing for mass production. Tama Dockyard Co., Ltd., making 750 c.c.-engined baby cars, trade name "Yashima."

The following interesting paragraph is printed, as issued by the Japanese Consulate :—"For some years past the Japanese manufacturer has been concentrating on the manufacture of parts and accessories for the popular makes of motor-cars, and has succeeded in establishing himself in overseas markets. At the present time by far the greater value of exports by the automobile industry has consisted of parts and accessories."—*Motor Trader*.

Reducing the Weight of Mine Equipment with Increased Safety and Economy

By JAMES A. RABBITT, Adviser and Acting Director, Japan Nickel Information Bureau

Following is the text of a lecture given by Mr. James A. Rabbitt at the 50th Anniversary Meeting of the Mining Institute of Japan, April 20, 1935, at the Railway Club, Tokyo.*

* * *

THE use of nickel as an alloying element in materials for the construction of mining equipment has been justified by the attendant gain of additional safety, reduction of weight, increased wear-resistance, and greater protection

from corrosion. For instance, nickel-chromium steel of high strength is used both to lighten weight of equipment and to increase the safety factor. For improving wear-resistance, alloy steels and alloy cast irons are used. For parts exposed to strong corrosion, austenitic steels and cast irons find use, and for special applications, various alloys are offered.

In a general way, an increase in safety factor and a reduction in weight go hand in hand with the use of nickel-chromium steels of high elastic limit. For the mine manager, the main object in using alloy steels for cage couplings, shafts, cars, gears, etc., is an increase in safety, but there may also be an important advantage in weight reduction, notably, for instance, in the case of cage couplings.

For other purposes, reduction in weight may be the main object desired. This is especially the case with hoisting equipment, rolling stock, tools, and generally all portable underground equipment. There is the added advantage of greater wear-resistance.

Because mining equipment must work under particularly hard conditions which necessarily imply heavy construction, it is decidedly advantageous to use alloy steel for such purposes, which will permit appreciable weight reduction along with increased strength and safety.

In a recent technical paper of the Central Committee of the French Coal Mines by L. Lahoussay†, the author points out that a continuous increase in depth of mine shafts makes it more and more necessary to look for appropriate means to reduce the weights and dimensions of equipment.

For mine cages, the possibilities along these lines are particularly interesting. For instance, a double-decked cage of four cars, made of soft steel and with an effective weight of 1,180 kg., was replaced with one made of a semi-hard alloy steel of the following approximate composition: carbon, 0.35 per cent; nickel, 2.6; chromium, 0.6 to 0.8, and molybdenum, 0.5 per cent; with double the ultimate tensile strength and elastic limit of the carbon steel. No modification was made in the form of construction, and the safety factors were higher than those of the cage displaced. With this cage, it has been possible to reduce the weight from 1,180 to 800 kg., a reduction of 380 kg., or 32.2 per cent.

In another case, a four-decked cage of two cars, used in a coal mine in the Saint Etienne basin, weighing 1,030 kg., built of soft steel, was replaced with one of alloy steel of the above composition, and a weight reduction of 396 kg. or 38.4 per cent was obtained.

From the cost standpoint, it is admitted that the substitution of relatively expensive materials for much cheaper steels implies an increase in the first cost of the cages. But making the cage lighter has as a direct consequence a reduction of the section and

weight of the wire rope, which is more important the greater the hoisting depth.

With a decrease of over 364 kg. in the weight of a cage, and a useful load of 1,140 kg. there would be an appreciable reduction in the weight of ropes. At present prices of ropes, the additional expense caused by lightening the cage would be compensated, beginning at a depth of about 900 m., through economy realized on the rope used.

A typical example of the advantage of using nickel-chromium steel may be cited. A cylindrical bar, to support in tension a load of 100,000 kg. with the steel stressed at two-thirds its elastic limit, would require a diameter of 63 mm. when made of plain carbon steel, quenched and drawn to 50 kg/mm² elastic limit, but only 36.5 mm. if made of a self-hardening nickel-chromium steel of 150 kg/mm² elastic limit. The weight of this nickel alloy steel bar would be only one-third that of the plain carbon steel bar.

For cage hoisting, standard hoisting equipment consists of the mine cage containing the cars, the cable to which the cage is attached, the sheaves and the hoisting engine. In design, the weight of the cage influences all other parts of the equipment—cable, sheaves, head frame and hoist. With the cage, safety is of course as important as reduction in weight: with the cage couplings safety is of first importance.

Reducing Weight of Cage

There is nothing new in the attempt to lighten the hoisting cage. Naturally, with progressively increasing depths of shafts, the problem has grown more important. As early as 1909 a paper was published in the *Revue Universelle des Mines*, in which the possibility of using nickel steel for reducing the weight of cages was suggested. At that time the steel mills were not in a position to comply with the demand for shapes needed in the construction. It had been pointed out‡ that with a mine hoisting by Koepe pulley, a decrease in weight of the



Fig. 1.—Couplings used for this Mine Cage are made of 2 per cent Soft Nickel Steel



Fig. 2.—Pins and Nuts made of Nickel-Chromium Steel

* From data obtained from the Center d'Information du Nickel, Paris, the Research Departments of the International Nickel Co., Inc., New York and the Mond Nickel Co., Ltd., London.

† Lahoussay, L. Comité Central des Houillères de France, Note Technique No. 198, Feb., 1933.

‡ Lucien, Neu. Soc. de l'Industrie Minière, Dec. 20, 1925.



Fig. 3.—Coupling Fork made of Nickel-Chromium Steel

cage from 5,550 to 2,000 kg. for the normal hoisting conditions for eight cars could result in a power economy of 16 to 17 per cent at the starting points. The author stated that the solution of the weight reduction problem lay in the use of alloy steels.

While the need of lightening the cages as far as possible within safe limits is the main object of the mining engineer, it must be noted that the problem of decreasing the dead weight vertically cannot be treated in the same manner as that for a decrease in

dead weight horizontally, as in railway hauling. In a mine shaft the dead weights are in principle entirely equilibrated; in practice they are very nearly so with modern hoisting apparatus. Therefore, the economy of power resulting from a reduction of dead weight does not present the same interest as in the case of horizontal haulage. The economy would be more static than dynamic, resulting mainly in reducing the dimensions of all the hoisting parts, cables, sheaves, head frame, engine and motors, and this weight reduction would permit reaching greater depths more easily.

Effect on the Weight of the Cable by Using a Lighter Cage*

An examination of the cable formula shows the importance of the weight of the cable on hoisting from great depths:

$$p \left(\frac{a}{c} - h \right) - P + Q_1 + Q_2$$

- P the useful load
 Q_1 the weight of the empty cars
 Q_2 the weight of the cage
 h the hoisting depth
 p the constant weight per unit of the cable
 c the safety coefficient of the cable
 a the ratio R/p , R being the ultimate strength of the cable.

For a cable of six strands of 30 wire, made of steel, with an ultimate strength of 180 kg/mm², the value of "a" is 17,050. The coefficient "c" being usually eight, it can be calculated that the hoisting depth for which "p" would become infinite would be about 2,131 m. This indicates the immense importance of the weight of cable with the hoisting depth, and the engineer's interest in its reduction.

It is to be noted, as well, that for a useful load of 4,400 kg. and a suspended total weight of 11,700 kg. with a cable of constant section, the weight of the unwound cable would be 1,845 kg. for a depth of 300 m., and 12,265 kg. for a depth of 1,100 m. The hyperbolic form of the above equation explains this rapid increase.

The influence of lightening the suspended load on the required weight of cable has been clearly outlined by L. Lahoussay. For examples, for a reduction in suspended weight of 1,800 kg. (a result that can easily be achieved by the use of nickel-chromium steels), we would have, for different depths, the following reductions in weight for each of the cables:

For depth of	200 m.	380 kg.
400 "	640 "	
600 "	970 "	
800 "	1,410 "	
1,000 "	2,020 "	
1,200 "	2,910 "	

TABLE I.

Required Weight of Cable for Extracting from the Depth of 200-1,200 Meters with Dead Weight of 300-9,000 kg. (Lahoussay)†

Depth of Extraction m.	Dead Weight kg.						
	3,000	4,000	5,000	6,000	7,000	8,000	9,000
200	4.30	4.83	5.38	5.91	6.45	7.00	7.53
400	4.82	5.43	6.02	6.62	7.23	7.83	8.43
600	5.48	6.16	6.84	7.53	8.21	8.90	9.58
800	6.35	7.15	7.93	8.73	9.52	10.31	11.11
1,000	7.55	8.50	9.43	10.37	11.32	12.26	13.20
1,200	9.30	10.46	11.63	12.80	13.95	15.11	16.27

TABLE II.

Total Weight of Cable for Extracting from the Depth of 200-1,200 Meters. (Lahoussay)†

Depth of Extraction m.	Dead Weight kg.						
	3,000	4,000	5,000	6,000	7,000	8,000	9,000
200	1.680	1.880	2.100	2.300	2.520	2.730	2.940
400	2.840	3.200	3.550	3.900	4.260	4.620	4.970
600	4.330	4.870	5.400	5.950	6.490	7.030	7.570
800	6.290	7.080	7.850	8.640	9.420	10.210	11.000
1,000	8.980	10.110	11.220	12.340	13.470	14.590	15.710
1,200	12.930	14.540	16.160	17.790	19.390	21.000	22.610

TABLE III.

Reduction of the Weight of Cable Obtained by a Diminution of 1,000 kg. on the Dead Weight. (Lahoussay)†

Depth of the Extraction m.	Reduction for a Diminution of 1,000 kg. on the Dead Weight	
	On the Metric Weight of the Cable kg.	On the Total Weight of the Cable kg.
200	0.540	210
400	0.600	355
600	0.684	540
800	0.793	785
1,000	0.943	1,120
1,200	1.163	1,615

Effect on Sheave Wheels, Drums and Hoist Motors by Using a Lighter Cage

The lightening of the cage and that of the cable, which is a direct consequence of it, have appreciable effects on other parts of the hoist installation.

Sheave wheels may be of smaller diameter because of the smaller size of cable, with consequent weight reduction. The head frame may be designed for a smaller load. Drums may be of less diameter. The hoist motor itself need not be so large. All these advantages would be especially important in the equipment of new shafts or for a change in an existing hoist, since they permit reducing the floor space required for hoist and motors, and thus a saving in capital expense.

In an existing installation it might not be advantageous to consider replacing sheave wheels or drums, but the advantage of using a lighter cage may be realized without any great modification in the existing installation. Thus the following effects might be considered:

1. Increase in the useful weight hoisted by an increase in the capacity of the cars.

* Fontaine, M. Léon, De L'emploi du Nickel dans la Construction du Material de Mines. Revue du Nickel Vol. 4, No. 2, April, 1933.

† Lahoussay, L. Allègement des Cages d'extraction, Revue du Nickel, April 1933, Vol. IV, No. 2, pp. 65-66.



Fig. 4.—Suspension Bolt of 1 per cent Nickel Steel "1D8" made for use of Decize Coal Mine



Fig. 5.—Coupling Bar of 2 per cent Nickel Steel "RN2" made for use of Bruay Mine

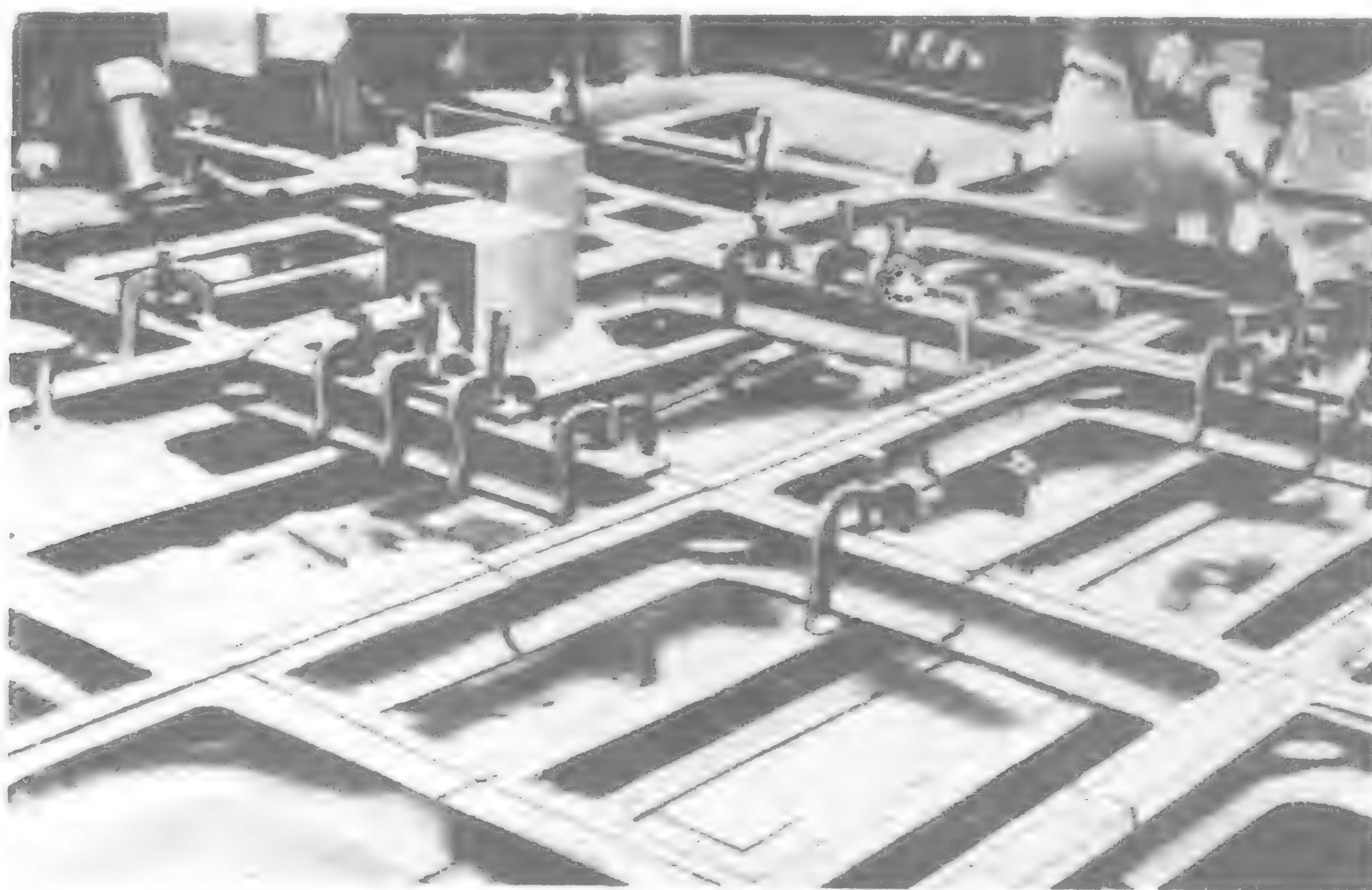


Fig. 6.—Tramway Crossing

2. Increase in the useful weight hoisted by increasing the number of cars per cage, either by adding more cars per cage deck, or by adding another deck to the cage.
3. Increase in the depth from which the

same engine could satisfactorily hoist. Lahoussay estimates that an increase of about 60 m. could thus be realized without any change in the engine.

4. Increase in both the number of cars per cage and the hoisting depth if the hoist capacity is sufficient. Use of nickel-chromium steels would permit, in this case, not only reduction of weight, but also assure an increase in strength of those members which would otherwise be too weak to carry an increase in suspended load.

Finally, it should be noted that while, in a mine shaft, the power economy resulting from reduction of dead weight could not be compared with that obtained from the same reduction in horizontal haulage, on account of the nearly perfect equilibration of the moving masses, it would still be appreciable. It would amount to two or three per cent during the normal hoisting, but could easily exceed 15 per cent at peak load. The reduction in itself is not negligible.

Three examples follow of the results obtained at typical French and Belgian collieries on the lightening of cages :

Collieries	A		B		C	
	Low Carbon Steel	Med. Carbon Ni-Cr. Steel Heat-Treated	Low Carbon Steel	Ni-Cr. Mo Steel Heat-Treated	Low Carbon Steel	Ni-Cr Steel Heat-Treated
Total stress at end of cable, kg. . .	36,900	34,770	13,340	11,535	12,200	10,135
Total weight of cage, kg. . .	6,533	4,823	5,700	3,895	4,630	2,704
Avg. safety factor . .	7.5	9.8	4.15	7.6	4.75	7.95
Total weight, cage, couplings and accessories, kg. . .	2,337	1,917	no data	no data	370	231
Avg. safety factor . .	7.3	11.0	"	"	8.7	14.3
Avg. increase in safety	no data	51%	"	"	no data	65%
Total weight, cage and couplings, kg. . .	8,870	6,740	5,700	3,895	5,000	2,935
Total weight reducing kg. . .	no data	2,130	no data	1,805	no data	2,063
Per cent wt. saved . .	no data	24%	no data	31.8%	no data	41.3%

Collieries	A	B	C
Type of hoisting	Koepe Pulley	Drum	Drum
Type of cage	4 decks of 2 cars	same	same
Coal capacity, kg.	3,800	4,160	4,160
Hoisting depth, m.	789	680	425

It is worth noting that the weight reduction obtained on each of these cases refers only to some parts of the equipment ; many parts were left untouched. If all the parts had been changed over, such as doors, bonnets, hand-rails, etc., there would have been further weight saving, amounting to about 1,820 kg. in the case of cage B.

We may conclude from this that it is not necessary to use steels of abnormally high elastic limit. Nickel-chromium steels having elastic limits of 42 to 65 kg mm², permit reductions in weight of the hoisting cage on the order of 25 to 40 per cent, at the same time increasing the safety factor on the average 40 to 50 per cent. It is estimated that the additional cost of using alloy steels instead of plain carbon steel in cage construction would be covered by the economy realized on the first cost of the cable when hoisting from a depth of 1,000 m.

Mine Cars

When a choice can be made between two materials of equal strength for the construction of mine cars, the engineer will not hesitate to specify the lighter of the two, due consideration being given to the first cost of each. A practical case will show the attendant economy of such a decision. If the dead weight of a car can be cut down and the saving in weight utilized for increasing the useful load, production can evidently be increased without expense for additional car equipment. From a hoisting standpoint, any reduction in the weight of the car will have the same advantage as decreasing the weight of the cage, with resulting benefits on the cable, head frame design, and hoist.



Fig. 7.—Nickel-Chromium Steel Chisels

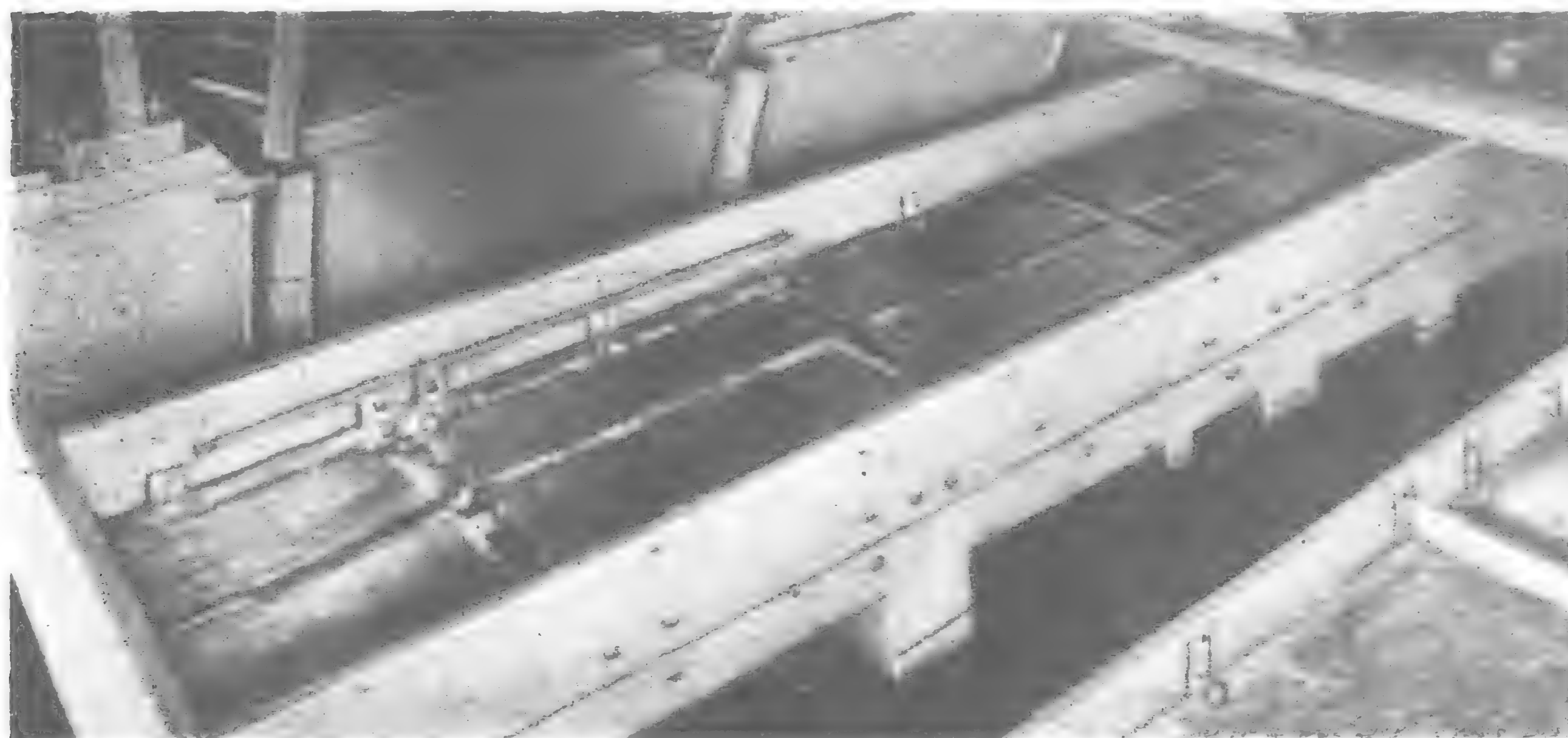


Fig. 7A.—Monel Metal Screens for washing coal



Fig. 7B.—Shaker Screens installed in Tipple having capacity of 350,000 kg. per hour

The weight of a 270 kg. mine car is made up approximately of the wheel assembly, 75 kg., framework and couplings, 80 kg., and sheets 115 kg. It is hardly advisable to replace the sheets of soft steel with nickel steel, as a minimum thickness of metal is needed to take care of wear. But the substitution of nickel-chromium steels for the wheels, couplings and framework will substantially reduce weight without reducing the strength of the car—in fact, the dependably higher properties of the nickel-chromium steels will increase the factor of safety.

Up to the present time little consideration has been given to the employment of nickel-chromium steels in the construction of mine cars to decrease weight, but they have been used quite extensively as a means of increasing strength, particularly in car axles. The axles formerly used for this purpose were made of plain carbon steel and, when exposed to violent shocks, were often bent or broken. Attempts were made to repair such shafts at the mine, but were not successful, and all kinds of trouble resulted from car breakdowns, derailments, etc. At one of the large French collieries, the change-over from plain carbon steel to 3.5 per cent nickel steel in the car axles was made seven years ago, and as a result, the number of bent or broken axles has fallen from between 130 and 150 per thousand annually, to only one or two per thousand. The properties developed by the nickel steel used for the axles are as follows:

Ultimate Strength	110 kg./mm ²
Elastic Limit	90 kg./mm ²
Elongation	7 per cent.
Mesnager Resiliency	8 kgm.

This steel is easily heat-treated (a simple water quench without draw), and possesses high mechanical resistance, with good resiliency and remarkable resistance to vibration and repeated shock. One of the most important collieries of the Pas de Calais is using, at present, about 25,000 axles of this nickel steel with gratifying results. In the iron mines of d'Homecourt they have found it advantageous to use a two per cent nickel steel for mine car axles. In other operations, car axles are made of a semi-hard nickel steel of the following composition:

0.3 carbon 2.0—2.2 nickel
0.5—0.7 chromium

Ultimate Strength	70 kg./mm ²
Elastic Limit	45 kg./mm ²
Elongation	22 per cent

Increasing the Safety Factor

A number of breakages of cage couplings have led to an investigation by the Mine Service of the Central Committee of French Collieries. This investigation has shown the inefficiency and danger of the quite generally applied periodic heat-treatments required by the French mining laws for maintaining in good condition couplings made of low carbon steels. The Committee, therefore, has advised that the use of these steels

be abandoned, and has favored the use of alloy steels for cage couplings. Their conclusions are as follows:—

To obtain the safest conditions with rigid and semi-rigid couplings without using too great dimensions, it is advantageous to use materials of higher elastic limit than that of the soft carbon steel. While the Martin or electric low or medium carbon steels, quenched and drawn, could be used, it seems preferable to use nickel steels for these reasons:

1. For the same ultimate strength these have a higher toughness and elastic limit than the carbon steels.
2. The presence of nickel reduces grain growth during the heating: the heat treatment, therefore, need be less elaborate, and minor heat-treating mistakes are of less importance.
3. Addition of chromium to the nickel steel by favoring depth hardening in quenching of heavy pieces, gives greater regularity in the mechanical characteristics of the finished products.



Fig. 8.—Mining Drills in operation

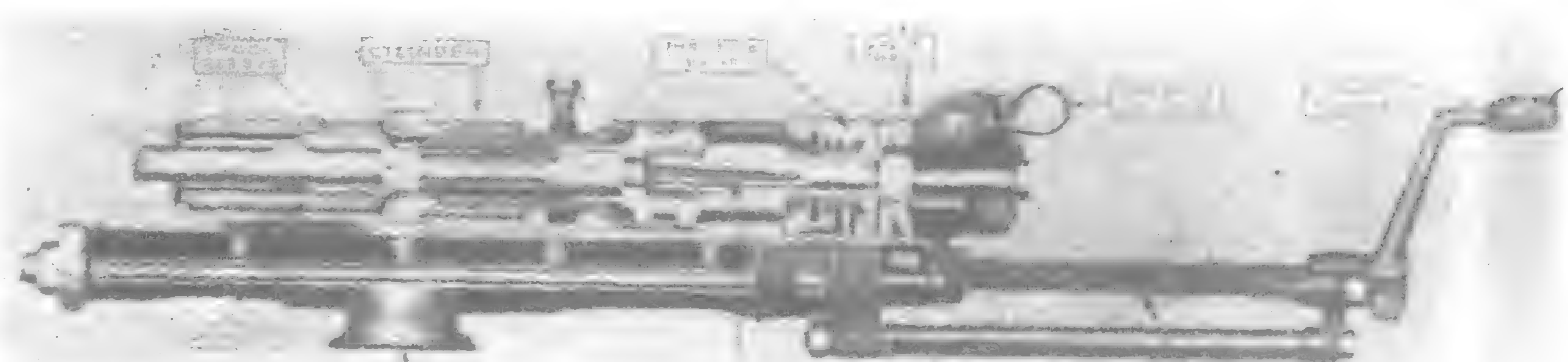


Fig. 9.—Drifting Drill with Nickel Alloy Steel Parts

4. For flexible couplings made up of chains, it is necessary to use materials that can be welded readily, and for such conditions careful heat-treatment of these pieces is required."

In all cases the heat-treatment must follow scrupulously the method given by the metallurgists, and furnaces must be used that are provided with means for controlling the temperature.

Even for flexible couplings nickel steels offer an excellent solution to the problem, and chains of cast nickel steel are readily available. A number of manufacturers have cage couplings of high strength nickel-chromium steel already in use with entirely satisfactory results. The coupling shown in Fig. 1 was made for Les Mines de la Loire of low carbon two per cent nickel steel. Les Mines de Blanzay use a nickel-chromium steel for various coupling pieces, suspension bars, pins and nuts (Figs. 2 and 3) with the following properties:

Ultimate Strength	70 to 80 kg/mm ²
Elastic limit	50 to 60 kg/mm ²
Elongation	15 to 18 per cent. Mesnager 12 to 18 kgm.

The coupling bars in use by Mines de Bruay are of two per cent nickel steel. That shown in Fig. 5 is 1.5 m. long, with a cross section of 180 mm. by 80 mm.

For a long time, in Belgium, cage couplings have been made of nickel-chromium steel. At the Charbonnages du Hasard, for example, pivots and suspension bars of air hardening nickelchromium steels have been used for the last 20 years.

The use of nickel-chromium steels for the cage couplings, besides increasing safety, has markedly reduced weight. Thus, for a cage coupling weighing 975 kg., it has been possible to reduce it to 555 kg. by substituting the nickel steel, in addition to increasing the factor of safety more than 50 per cent.

For increasing safety, nickel or nickel-chromium steels are highly desirable for car couplings and coupling hooks for cables in incline shafts. The importance of freedom from unexpected breakage of couplings in horizontal and inclined haulage ways needs no emphasis, and the replacing of mild steels with a more resistant material is in many cases a necessity.

There are three main causes of breakages in the coupling. There may be a clean break from simple shock when the metal is too brittle. Breakage may result from progressive fracture from repeated shock, or finally, from wear at contact of the link. To avoid breakage, it is best to use a steel of high elastic limit with an average resiliency of at least 10 kgm. in a Mesnager test piece. Other means could be considered, according to the heat-treatment that might be used,



Fig. 10.—Hardypick "Miracle" Nickel-Chromium Shovel



Fig. 11.—Nickel-Chromium Steel Shovels "Miracle" made by Hardypick, Ltd.

with steels of the following compositions and characteristics at either extreme:

1.—Medium Carbon Nickel Steel Simply Annealed

0.25 to 0.30 carbon

3.0 nickel

Annealed at 850°C after die-casting and cooling in air.

CHARACTERISTICS

Ultimate strength	60 kg/mm ²
Elastic limit	38 kg/mm ²
Elongation	20 per cent.
Mesnager resiliency	10 kgm.

2.—Medium Carbon Nickel Chromium Steel
Oil Quenched and Drawn

0.25 to 0.30 carbon

2.5 nickel

9.8 chromium

Quenched in oil at 825°C, drawn at about 600°C

CHARACTERISTICS

Ultimate strength	85 kg/mm ²
Elastic limit	70 kg/mm ²
Elongation	15 per cent.
Mesnager resiliency	12 kgm.



Fig. 12.—Holman Drill in operation

The 3.5 per cent nickel steel can be used even when subjected to heavy shocks, although it has a resiliency somewhat less than the limits given above, due to its higher elastic limit.

Resistance to Wear with Nickel Alloy Steels

Wear is a subject of interest to all engineers. Could they eliminate it their resources in the matter of design would be enormously increased and their expenditure on replacements considerably reduced.

Many are the means adopted to reduce wear to a minimum, but the solution of the problem is complicated by the difficulty of reproducing on a small scale, or in the laboratory, the conditions of wear which arise in practice. Several useful machines have been devised in order to gain some knowledge of the fundamentals of wear and its prevention by means of lubrication, but, although interesting and valuable results have been obtained, it is still impossible in most cases to say beforehand whether any particular material will certainly give good service in a particular location.

In the fight against wear, nickel-containing steels have played, and are playing, a prominent part. The possibility which they give of combining in one material varying degrees of hardness with considerable toughness, and of varying properties by change of composition and heat-treatment, have resulted in their being employed to withstand many different types of wear.

(To be continued)

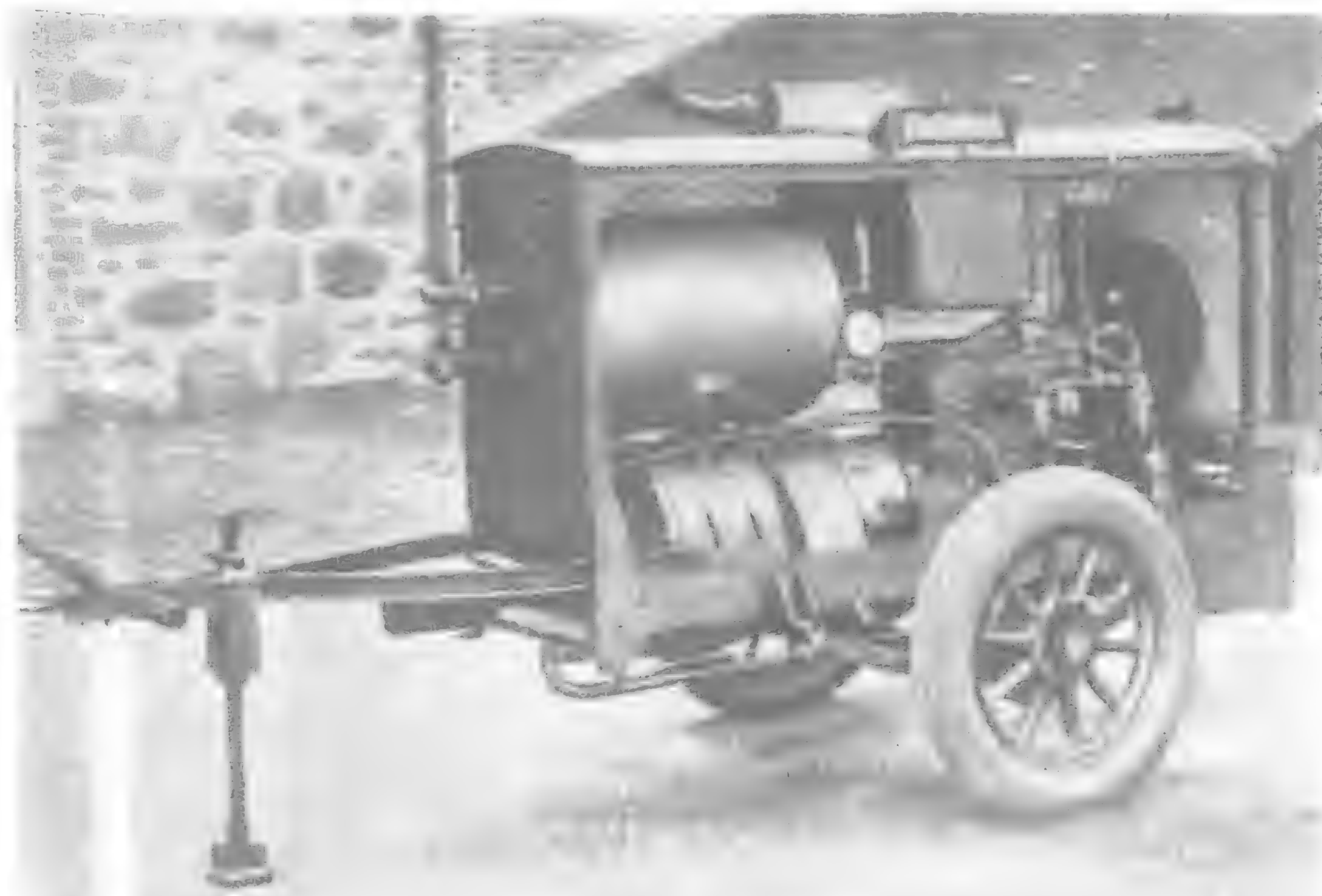


Fig. 13.—Hele-Shaw Beacham Portable Air Compressor

Working of the Ghat Inclines on the Great Indian Peninsula Railway

By O. S. M. RAW, in the "Craven Machine Tool Gazette"

THE Great Indian Peninsula Railway is one of the pioneer Railways of India, and forms the outlet from Bombay to South and Central India, and one of the routes to Delhi and the North, the other route to Delhi being provided by the B.B. & C.I. Railway. Bombay lies on the coast, from which a flat plain at more or less sea-level stretches inland for 30 or 40 miles. This plain is known as the Konkan, and stretches along the seaboard to the South of India. About 30 miles inland from Bombay the land rises sharply to a height of over 2,000-ft. above sea-level, this high land being known as the Deccan. The Deccan plain extends at this altitude across the greater part of India, and then slopes down gently to the Bay of Bengal.

Obviously this sudden change of altitude was a very great obstacle to the early pioneers in Railway construction, there being very few places where it was possible to build a road through, let alone a Railway. The matter is further complicated by the fact that the G.I.P. Railway has two separate routes, the Northern lines to Delhi, Calcutta and Nagpur, ascending by the Thul Ghat, and the South East main line to Madras and Secunderabad, ascending by the Bhore Ghat. As the editor would no doubt put an impatient blue pencil through too long an article, I propose to deal solely with the Bhore Ghat incline.

The Bhore Ghat incline can be taken as extending between Karjat and Lonavla stations, and was opened for traffic in 1863. In those days it was a work of great magnitude, the average number of men employed being thirty thousand, with a maximum of forty-two thousand employed in 1861.

The Ghat section is 15 miles 68 chains long, involving a climb of 1,831-ft., with an average gradient of 1 in 48 and a maximum of 1 in 37. This latter gradient occurs between the Reversing Station and the Summit, the maximum gradient below the Reversing Station being 1 in 40. As originally planned, the line was to have followed the present alignment almost exactly, but for reasons of economy the Reversing Station at Battery Hill was introduced. By its introduction the gradients were appreciably eased and a very great deal of tunnelling and heavy work avoided:



Train emerging from Tunnel on New Alignment

although the mileage was increased by $\frac{3}{4}$ mile, the cost was reduced by very nearly £50,000.

A short and very sharp curve of 10 chains radius was constructed, but as it occurred on a 1 in 75 grade near the Reversing Station, where high speeds were impossible, it was not a very serious hindrance to traffic.

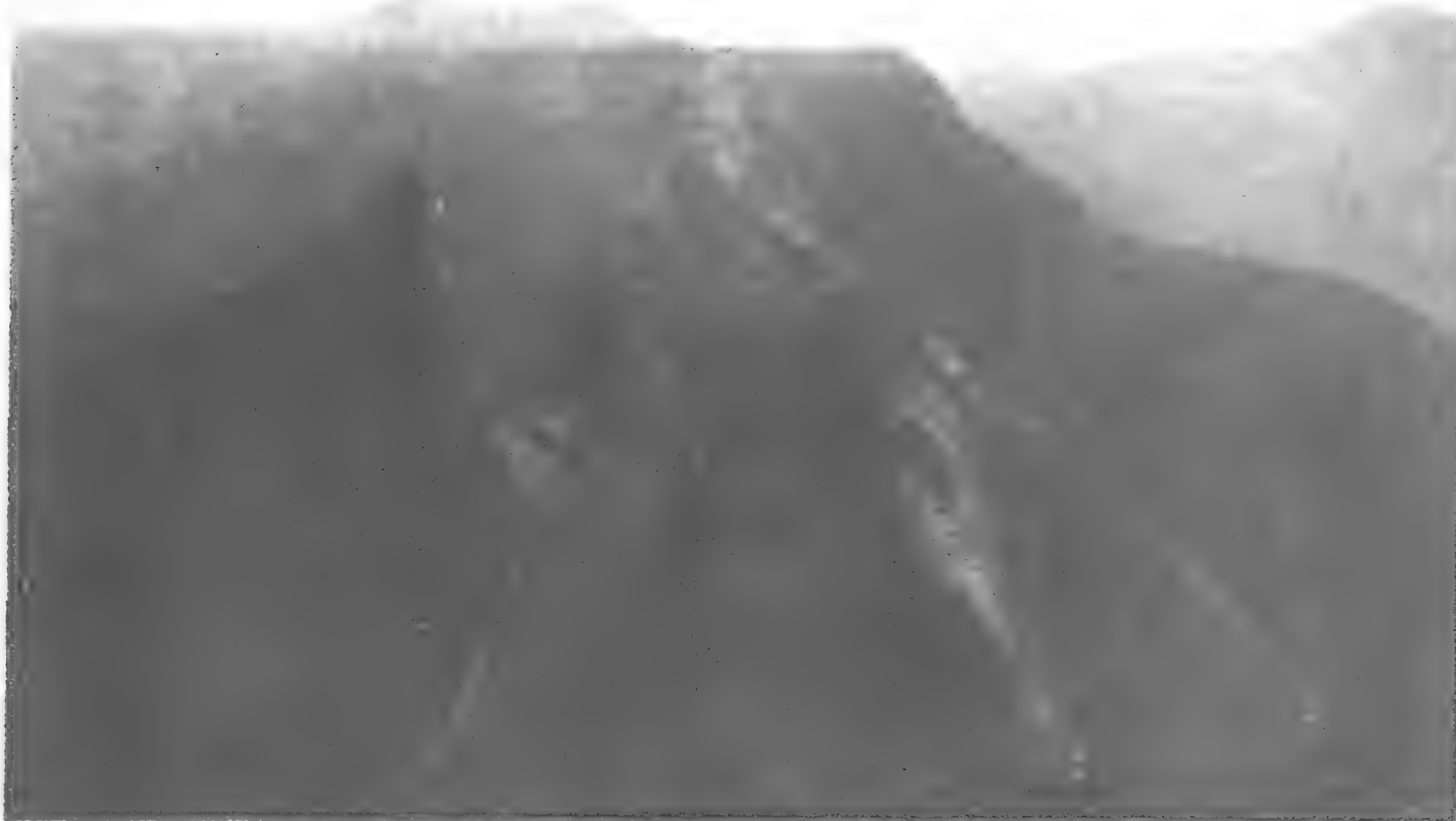
It will at once occur to the reader that a Reversing Station would limit not only the speed of operation, but also the length of the trains to that of the Reversing Siding. This was not, however, so serious, as the traffic was slow and comparatively sparse, but what was more important, the trains were limited to less than the length of the Reversing Siding by the low haulage power of the locomotives, the absence of continuous brakes and the weakness or strength of the existing couplings. Engineering progress was rapid, however, and by the beginning of this century locomotives were built which were capable of hauling loads and trains of much greater length than the Reversing Siding could accommodate, with the result that they became a hindrance in dealing with the increased amount of traffic.

Although plans were put in hand for the realignment of the line, all work was suspended during the War. The plan was, however, actively taken up in 1923, and a thorough survey made. The limited length of trains was seriously hampering the traffic, and two courses were open to the Railway. The first was to make a new alignment eliminating the Reversing Siding, and the second was to extend the length of the Reversing Siding. The latter was very expensive, as it would have involved a viaduct over 100-ft. high, Battery Hill being on a bluff. In addition, this plan would not overcome the difficulties of the Reversing Siding bottle-neck. On the other hand, by carrying out the realignment very great economies in working costs could be made under the heads of staff displaced from the Reversing Station, reduced train mileage and running times, and saving in the number of locomotives required.

It was, therefore, decided to proceed with the realignment. The work was put in hand in 1926 and completed for traffic by April, 1929.

A great deal of tunnelling was required, but at the same time two great improvements were made. These were, a reduction of the maximum grade from 1 in 37 to 1 in 40, and an increase in the spacing between the centers of the tracks from 12-ft. to 15-ft. 6-ins.; this latter dimension visualized the employment of 12-ft. stock for the heavy Poona-Bombay passenger services in the future.

The sketch map shows the work involved in the realignment, and the great length of tunnels. The latter are on a 5° curve, and the spacing of

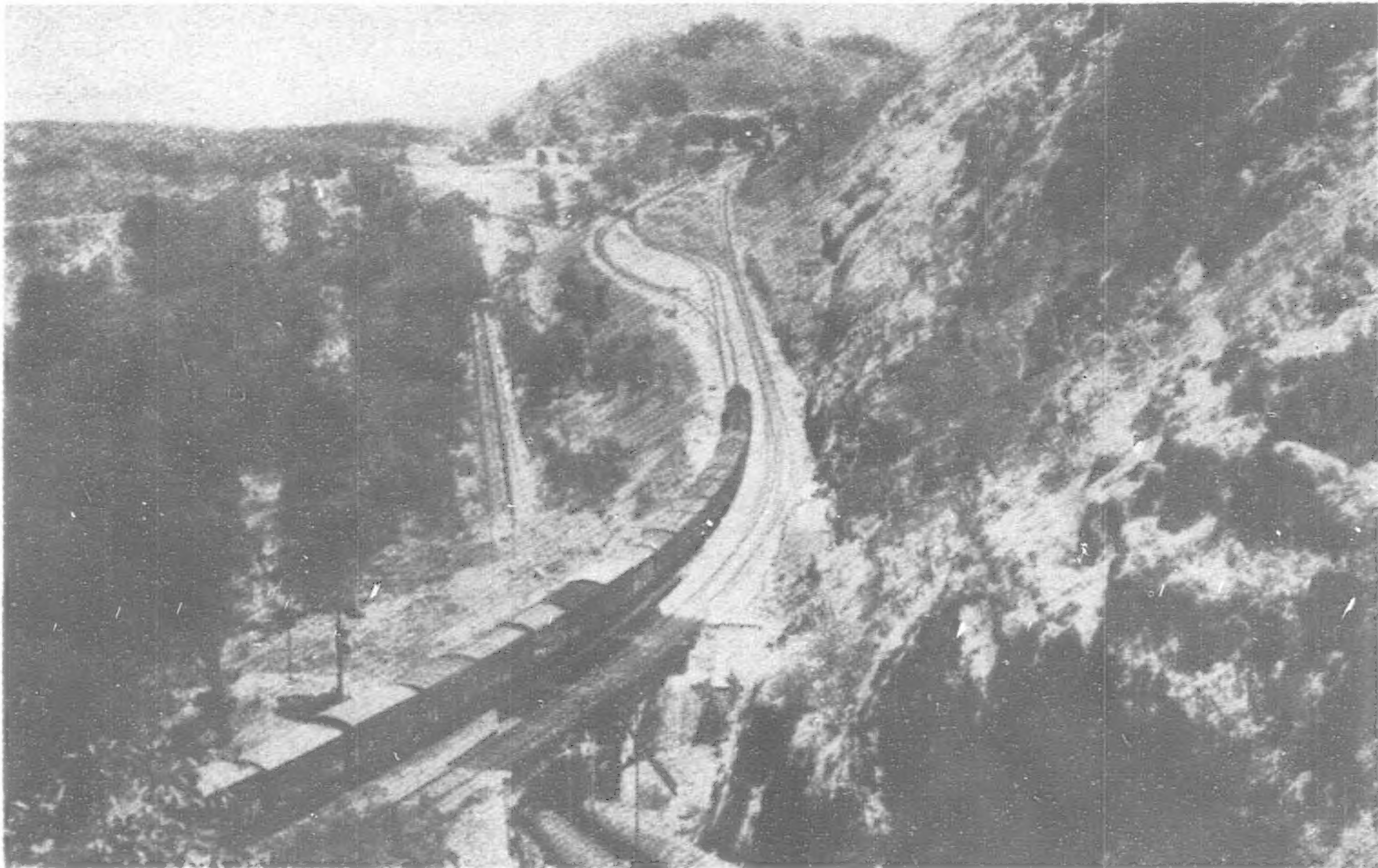


A Typical Scene on Bhore Ghat

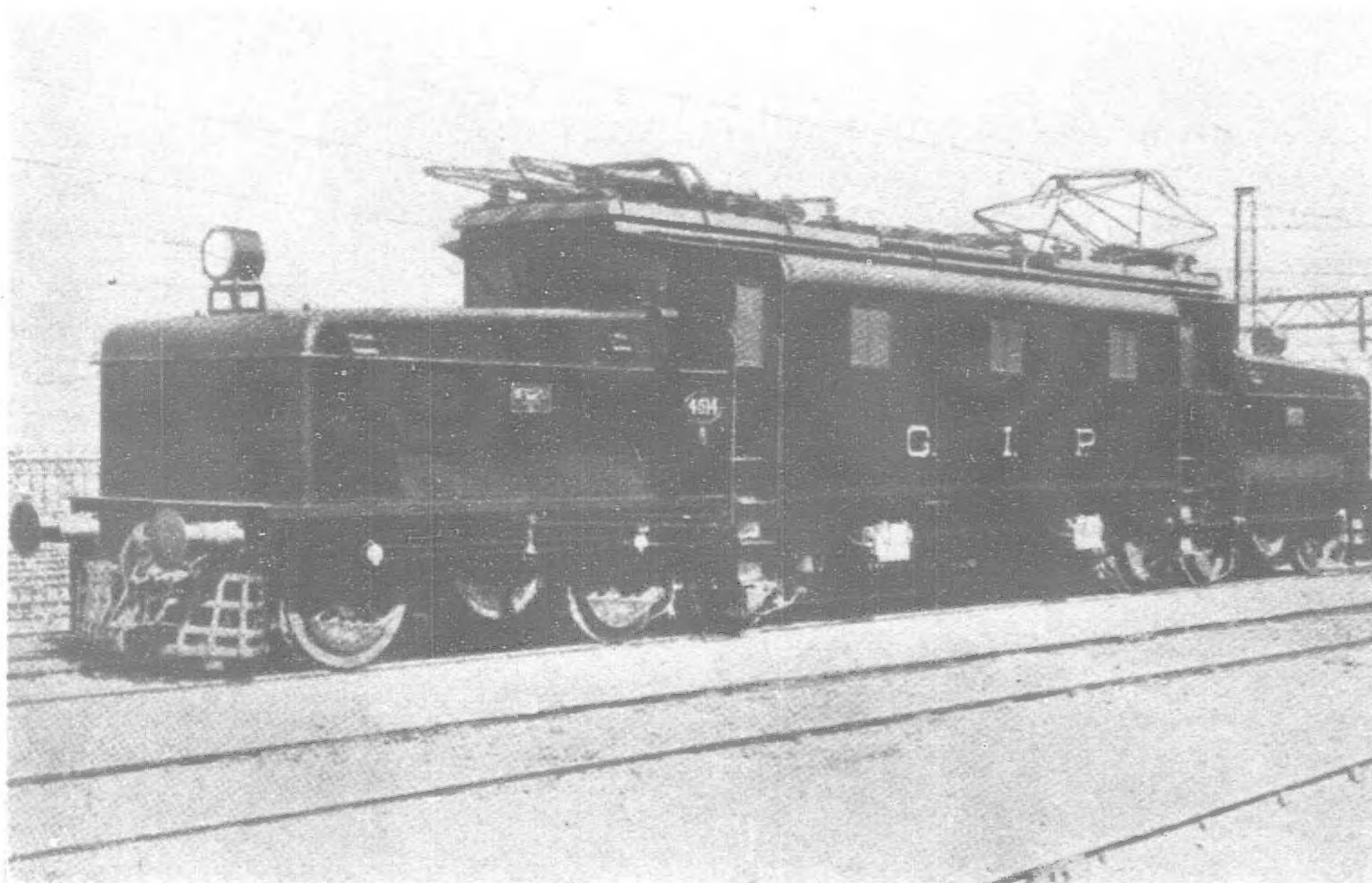
the track centers are increased to 16-ft. 7-in., involving tunnels 34-ft. 6-in. wide by 22-ft. 10-in. high, possibly the biggest double-line tunnels in the world.

At the outset, in order to work the traffic efficiently special locomotives were provided. These were built by E. B. Wilson, of Leeds, in 1857, and were four-coupled saddle-tank engines coupled back-to-back in pairs. A similar arrangement had been used by Stephenson for working the Giovi incline, and, again, in England, in the 1870's by the Cornwall Mineral Railway, for working their heavy gradients. These engines had 4-ft. diameter wheels and 15-in. by 22-in. cylinder, but, like the previous applications, the double locomotives were not a success.

Accordingly, in 1862, some saddle-tank engines were designed by J. Kershaw, and built by Sharp Stuart. They have the distinction of being some of the ugliest engines built, and also the first to be constructed in England with a bogie which could slide laterally. The controlling force to the sliding bogie was by inclined planes and not springs, but the whole effect was spoilt by having a 3-ft. 6-in. wheel-base for a 5-ft. 6-in. gauge Railway—a ridiculous dimension. These engines were 4-6-0 "tanks," with outside frames and cranks, the only ones, I believe, ever built for the Indian broad-gauge. Some of their main features were: all-compensated springs giving 3-point suspension, 20-in. by 24-in. cylinders, and sledge brakes. The boiler gave 1,438 sq. ft. of heating surface, with a grate area of 26 sq. ft., and a weight of 38 tons on the coupled wheels. These dimensions were colossal for the period, but the engines were never a success, probably on account of the many innovations of design. A peculiarity of these



New Alignment—Battery Hill. Note Hydro-Electric Pipe Line and two Locomotives at Head of Train



2,600 h.p. Freight Locomotive—used for banking on Ghats

and the Wilson engines was that no cab or protection was provided for the drivers. Engine drivers were reputed to be hard-headed in those days, and this presumably was meant to be their only protection from the tropical sun. Unfortunately no illustrations are available of these two early types.

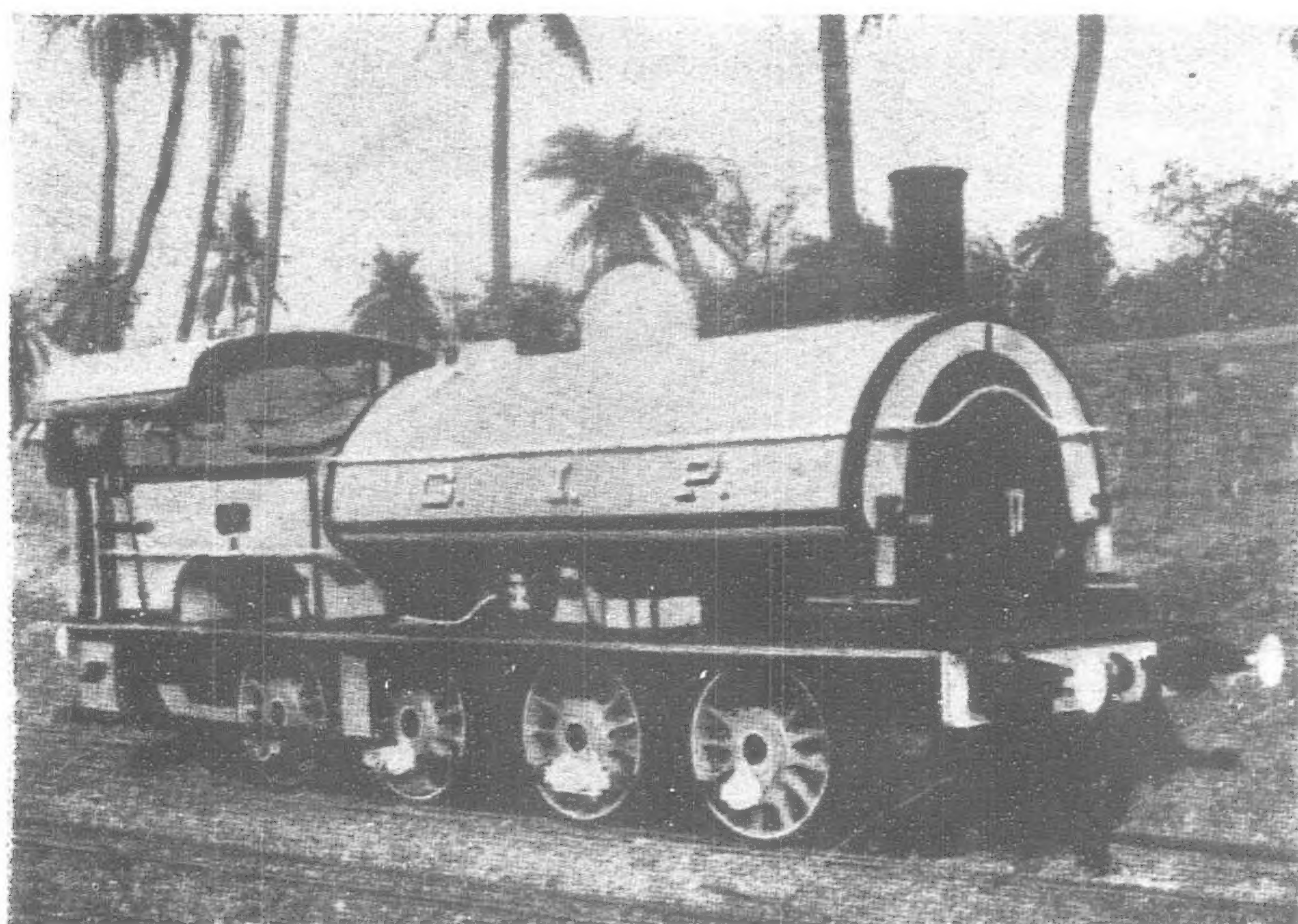
In the 1880's, a special Ghat tank-engine was designed, and large numbers were built by the Vulcan Foundry and Neilson & Co. These engines gave, and still continue to give, yeoman service, and are known as Class "W." They are 8-coupled tank engines, with 18-in. by 26-in.

cylinders, 4-ft. driving wheels and 1,260 sq. ft. of heating surface. These dimensions may appear to be retrograde compared with those of the preceding 4-6-0 "tanks," but the boiler pressure had been increased from 120 to 160 lb. per sq. inch, and the "W's" were an all-round better engine. They reigned supreme on the Ghats until the advent of the "Y's" in 1906. The "W's" such as remain, are now used for shunting, and one is usually to be seen at Victoria Terminus, Bombay, marshalling the mail trains.

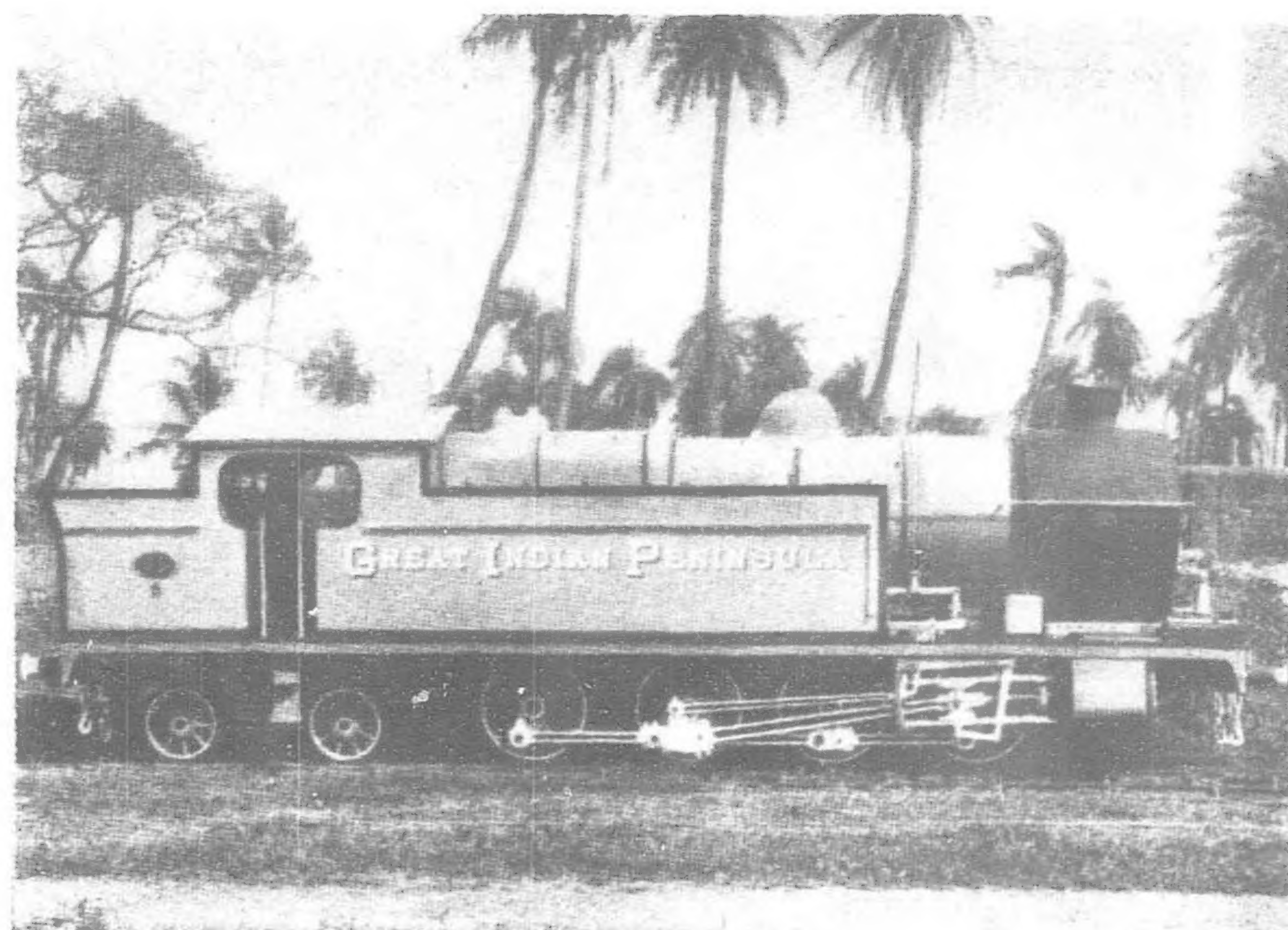
The "Y's" were originally built as 2-8-4 "tanks," but the later batches were constructed as 0-8-4's as trouble was experienced with the leading trucks, and were, therefore, designed to increase the adhesion weight. The dimensions of the "Y" class are, cylinders 20-in. by 26-in., heating surface 2,017 sq. ft., boiler pressure 180 lb., weight on coupled wheels 78 tons, total weight 101 tons. The tractive effort at 90 per cent boiler pressure is 33,035 lb. These engines met the traffic requirements until the electrifications in 1930. The "Y's" are too heavy for yard-shunting, and are now kept stored in sheds,



Battery Hill Reversing Station—Note Catch Siding



G.I.P.R. "W" Class Locomotive

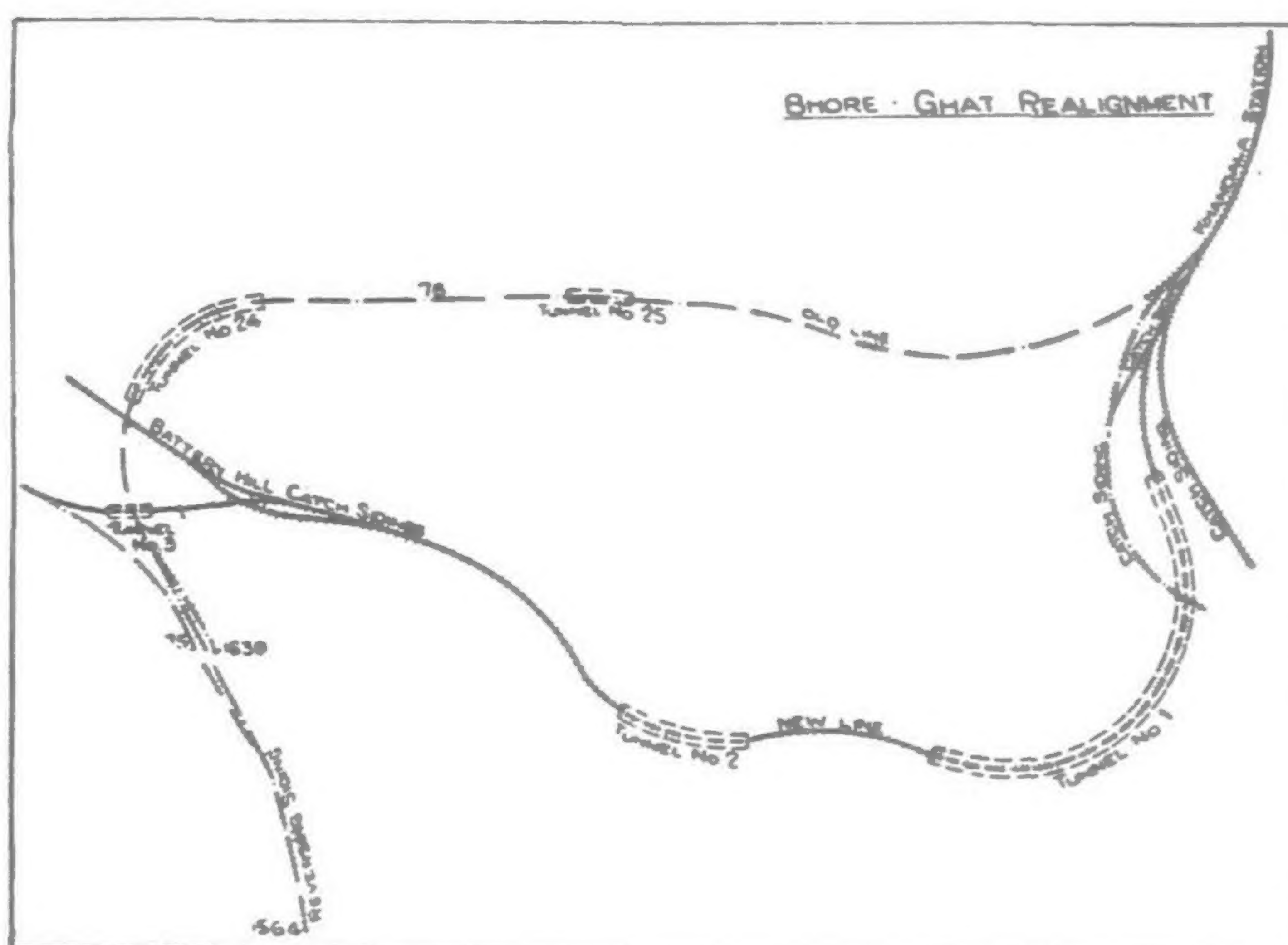


G.I.P.R. New "Y" Class Locomotive

although a large number have been sold to another Railway for use on colliery branch lines.

Electrical working is now in force, and not only are higher speeds attained, but it is unnecessary to divide the heavy goods trains of 1,600 tons.

With the very heavy gradients it can be readily understood that very special safety precautions have to be taken. All ascending trains must have a banking locomotive at the rear, in case a coupling should part. Also catch-points and sidings are provided, these climbing dizzily up the side of the hills in a manner reminiscent of the "Giant Racer" at the Wembley Exhibition. In the steam days, a heavy goods-train would have two banking engines, with the result that the crew of the last engine were often



almost asphyxiated in the tunnels.

For the descent, two locomotives must be at the head of the train. The banking engines are fitted up for regenerative braking, which, amongst other things, effects a great saving of brake blocks. Descending trains must stop at Battery Hill signal box, and, until they have stopped, the catch siding points are not opened to allow the train to proceed down the main line.

The electrification of the G.I.P. Railway has been a financial success, but, even if it had not, the improved working of the Ghat sections would go a very long way towards its justification.

I must express my appreciation for help given me by the Publicity and Chief Engineer's Departments of the G.I.P. Railway, in the preparation of data for this article.

Taiwan Electric to Enlarge Plant

A GREAT change has been introduced by the electric commission of the Communications Ministry into Japan's Five-Year Power Supply Plan, sponsored by the Ministry, as the result of a marked change that has come over the electric situation since the time the plan was formulated in 1933, the *Kokumin* reports. The demand for electric power has kept increasing rapidly in line with general industrial progress and, more specially, the prosperity of the munitions industry. The demand has already exceeded the original estimates fixed by the Ministry and experts of the leading power companies. And, thus the Ministry has found it necessary to revise the figures already fixed, while many electric power companies have resumed the construction of power stations suspended some years ago during the business depression.

The estimated maximum supply of power for the five years between 1935 and 1939 has been revised to 1,360,000 kilowatts and the estimate of new power generation for the period revised to 340,000 kilowatts.

The Taiwan Electric Power Company has decided to supply 15,000 kilowatts of power to the Formosa Gold Alloy Industry Company, which will be established shortly, with a capitalization of Yen 5,000,000, under joint investment of Taiwan Power and the Electro-Chemical Industry Company and through the efforts of the Mitsui interests, *Rengo* reports. Taiwan Power now generates 120,000 kilowatts with the completion of its Jitsugetsutan power station. Out of this amount, 50,000 kilowatts are supplied to

various industrial plants in Formosa, 27,000 kilowatts will be supplied to the Japan Aluminum Company to be founded through joint investment of Mitsui, Mitsubishi, Sumitomo and Furukawa interests, and 15,000 kilowatts to the new gold concern. This makes a total of 92,000 kilowatts, leaving 28,000 kilowatts yet to be sold.

Taiwan Power however has decided to build additional generating equipment, by which 40,000 kilowatts are to be generated by utilizing the water power at the Jitsugetsutan Station No. 1. Work for this is expected to be started in May. Construction expenses are estimated at Yen 1,190 per kilowatt, which is said to be very cheap. Total expenses are estimated at Yen 7,600,000. The company raised the funds needed for construction of the Jitsugetsutan Station No. 1 in the United States under Government guarantee. Because of difficulty to raise additional loans in America, Taiwan Power has decided to get the money at home and is now negotiating with financiers. It is expected the company will be able to borrow Yen 5,000,000; and as it takes Yen 8,000,000 for the whole work, about Yen 2,000,000 will be raised out of funds set aside for the No. 1 Station.

The company has also decided to engage the services of Mr. Shoji Hayashi, who used to be connected with the Toho Electric Power Company and the Yahagi Hydro-Electric Power Company, as chief engineer of the proposed work. He will leave Tokyo shortly for Formosa to take up his new duties.

Hollow Shaft Pump Motors

New Design of Vertical Spindle Pump Motor Completed by the British Thomson-Houston Company

A NEW design of vertical spindle pump motor recently completed by the British Thomson-Houston Company, to the special order of an export customer, is of special interest in view of developments in water supply in Great Britain. The new motor is known as the Type GH, and is built in sizes ranging from 15 to 60 h.p. at 1,500 r.p.m.

The two principal features of the new machine are that it has a hollow shaft and very heavy thrust capacity bearings. The size of these bearings is such that the total thrust of the pump may be taken by the motor, and this, combined with the hollow shaft enables a new form of pump drive to be adopted.

In the normal vertical motor pump drive there is a standard vertical spindle motor driving downwards through a flexible coupling to the pump shaft. The pump thrust and weight are taken by the pump thrust and guide bearings situated above the delivery head. With this arrangement the motor usually stands on a pump stool of appreciable height.

With the new hollow shaft heavy thrust pump motor the top thrust bearing of the pump is eliminated. The flexible coupling is also eliminated, with the result that the motor stands on a much shorter and sturdier stool. The pump shaft is taken up through the hollow shaft of the motor into a coupling, which is provided as part of the machine, above the top motor thrust bearing. Some of the advantages of the latter arrangement may be seen from Fig. 1. All adjustments to the pump clearances take place at the top of the motor in a very accessible position, and the thrust bearing itself is easily exposed and inspected.

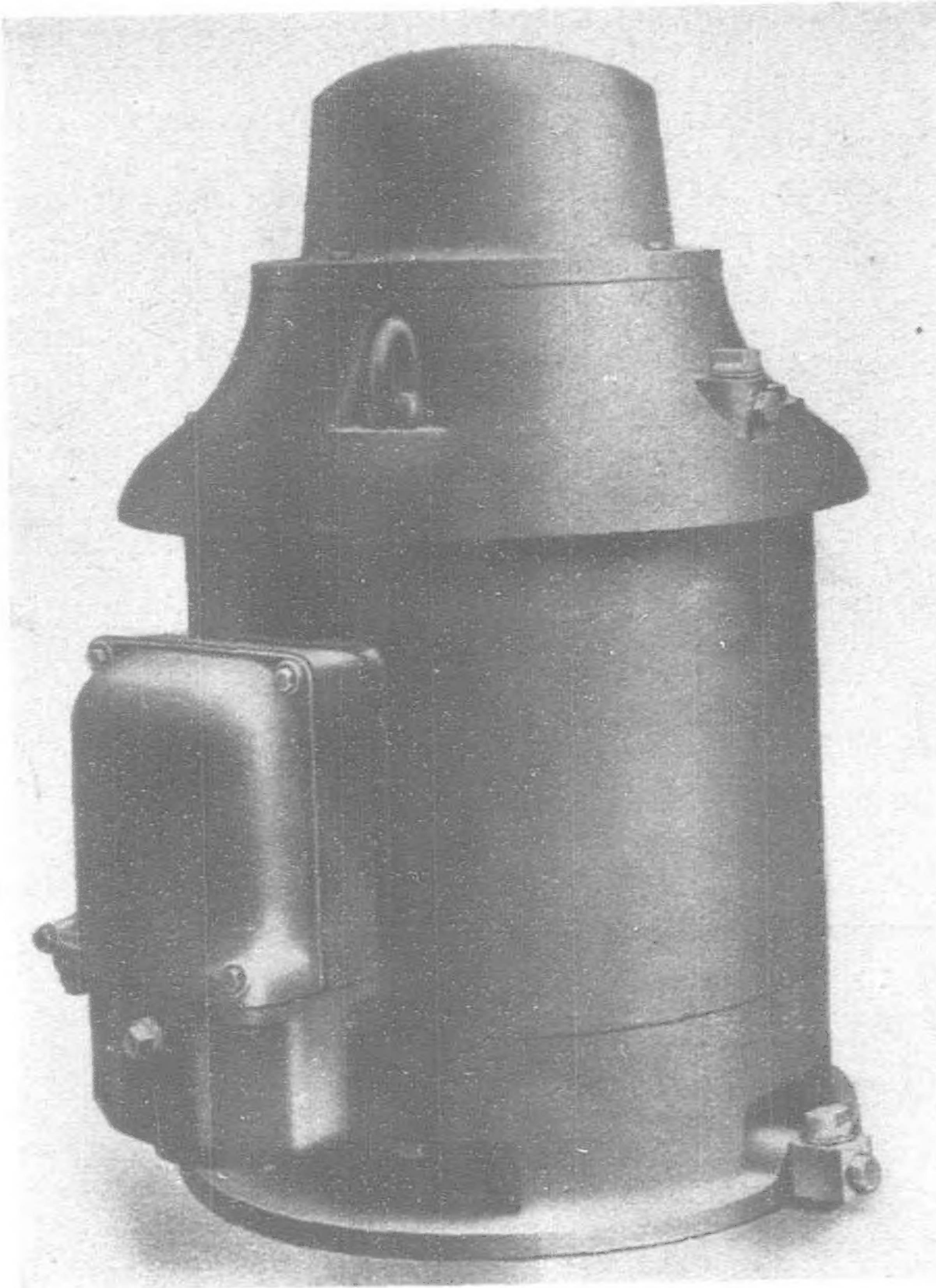
It will be evident that the success of such a motor depends to a considerable extent upon the very adequate thrust bearing capacity, and in the continuous lubrication of such bearings. With this motor the bearings are oil lubricated with a self-contained oil circulating system. The oil wells, particularly with the thrust bearing, are very large.

The coupling which is supplied with this hollow shaft motor is of the metal pin type, and may be used in conjunction with pump shafts with screwed couplings along the pump shaft. This necessitates the motor run-

ning in one direction of rotation, but should the motor by accident be rotated in a wrong direction, then no harm will be done to the pump, since one of the line couplings will unscrew to the extent that it will lift the top half of the coupling clear of the driving bottom half.

As the motor is designed for vertical pump duty only, and with a ventilating system best suited to that specific duty, it is possible to adopt a stream-line exterior with air discharging downwards from the rim of the top endshield. Air enters the bottom or side of the bottom endshield, and is drawn upwards by a cast aluminium fan at the top of the motor. This smooth stream-line exterior is absolutely drip-proof and even rain would not enter or harm the motor.

The stator has taped end windings which are specially treated to withstand moisture and oil, and are braced to withstand shocks of direct starting. In connection with starting, the primary design of the motors is double squirrel-cage to keep the starting current down to a low value. They may also be built single squirrel-cage, with slightly higher



Hollow Shaft Pump Motor

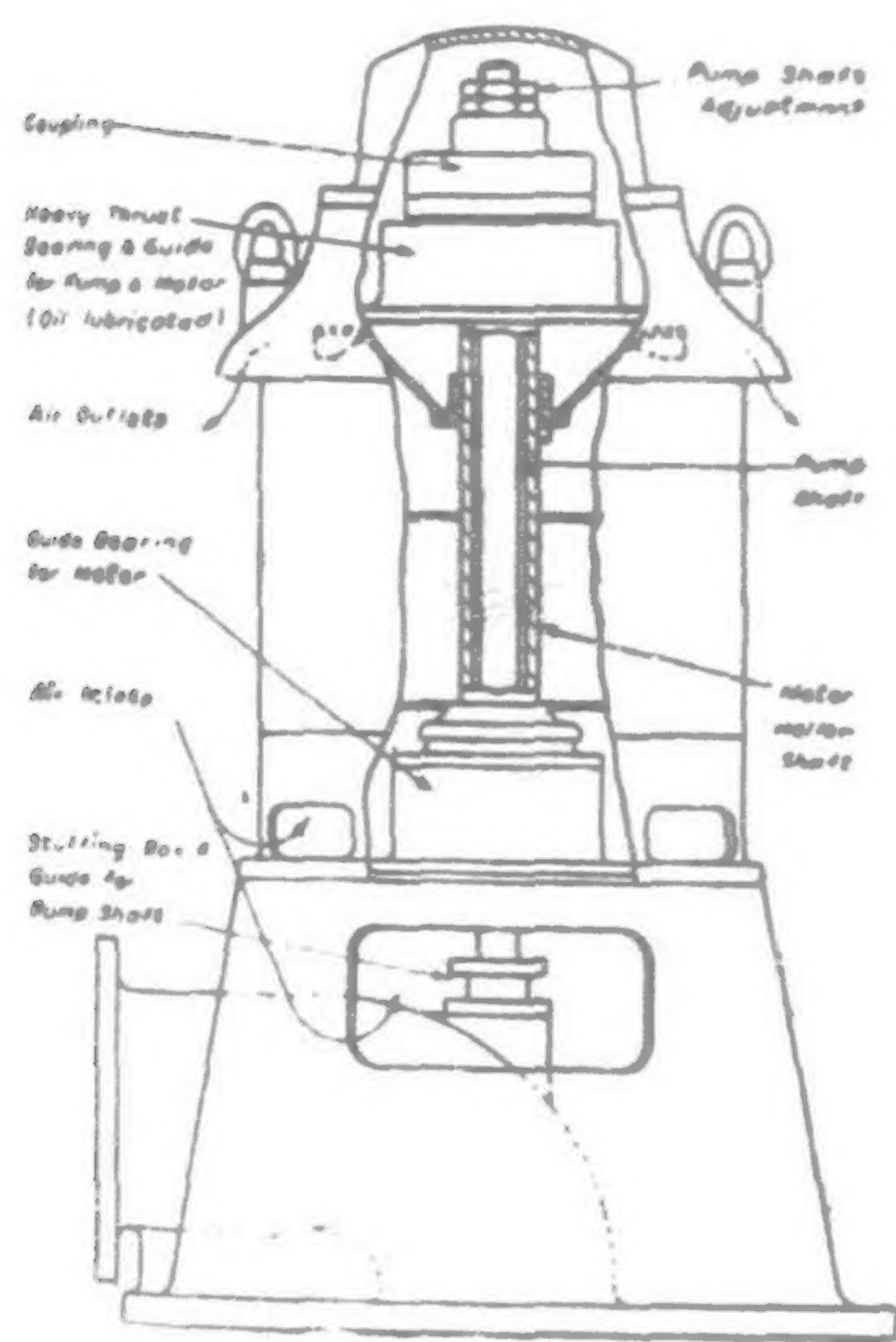


Fig. 2.—Arrangement of 50 h.p., 1,500 r.p.m. Hollow Shaft Motor on Pump Head

efficiency. Cast aluminium rotors are used in both cases; all the rotors are dynamically balanced.

Although the range of the motors covers 15 to 60 h.p., only two dimensions of mounting are adopted. This enables the pump maker to interchange motors for the same pump head over an appreciable range of horse-power.

The units are easy to assemble and dismantle; it is only necessary to remove four bolts to lift out the top endshield complete with its rotor and bearings. The top bearing is a heavy ball thrust bearing and the bottom bearing is a roller bearing. The latter is a guide bearing only, and it is so arranged that the inner race with the rollers in position will lift clear of the outer race, which is left in the endshield. Both bearings are assembled on sleeves which are easy to remove from the shaft.

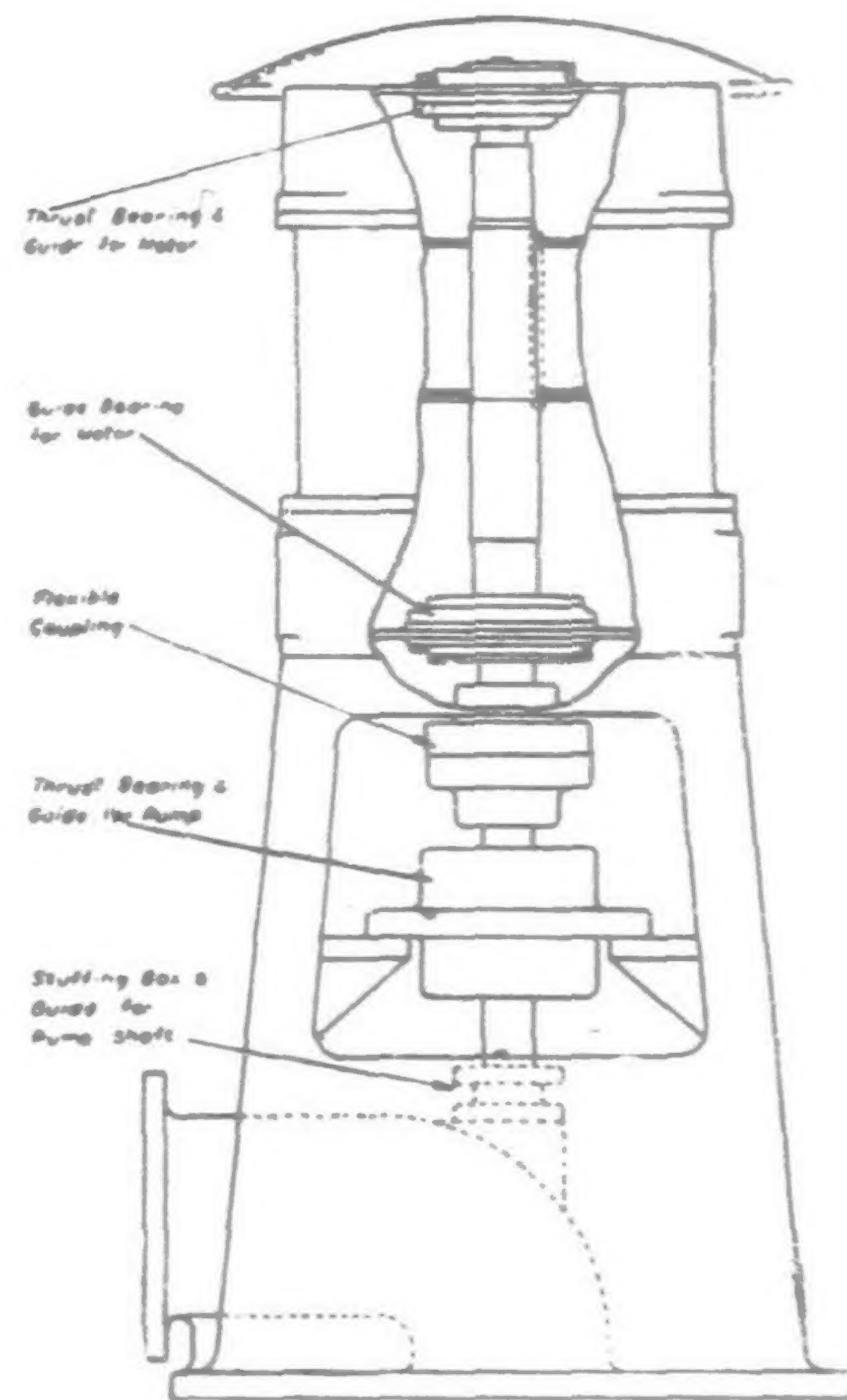


Fig. 3.—Arrangement of 50 h.p., 1,500 r.p.m. Solid Shaft Motor on Pump Head with Separate Flexible Coupling and Bearing for Pump Thrust

Dr. Langmuir Honored by Japan

Dr. Irving Langmuir, associate director of the General Electric Research Laboratory at Schenectady, has been awarded the Fourth Order of the Rising Sun by the government of Japan, where he has been delivering a series of lectures for the Iwadare Foundation, which is operated by the Japanese Institute of Electrical Engineers. The decoration is bestowed by Japan in recognition of distinguished service.

Subjects upon which Dr. Langmuir, recent Nobel prize winner in chemistry, addressed the Japanese scientists included "Fundamental Industrial Research," "Surface Chemistry," and "Electric Discharges in Vacuum and Gases at Low Pressures." The series of six talks included two on each of the three topics.

Engineering Notes

INDUSTRIAL

PULP FIRM PLANNED.—Mr. Mitsutoyo Aruga, president of the Chosen Industrial Bank, Seoul, plans to found a pulp-making company with a capital of Y.20,000,000. The factory is likely to be erected in the North Kankyo district of Korea.

SINGAPORE SEWAGE SCHEME.—The President of the Municipal Commissioners of Singapore (Mr. W. Bartley) has put forward a resolution with regard to raising a \$4 million loan for a new sewage scheme and other public utility works.

BLAST FURNACE AT KUZNETZ.—On December 21, the fourth blast furnace at the Kuznetz (Stalinsk) metallurgical plant was blown in. The furnace is the 115th in the U.S.S.R. The first pourings of pig iron were entirely satisfactory.

S.M.R. SODA WORKS.—The South Manchuria Railway Company's scheme to launch a soda industry may not materialize, due to opposition from soda companies in Japan who fear over-production during the next few years. Many soda manufacturing concerns in Japan have been expanding their plants.

SHANGHAI MACHINERY ORDER.—Messrs. Gregson & Monk, of Manchester, have been given a £50,000 contract for machinery for 1,500 looms for a Shanghai mill. This piece of business is a direct sequel to the informative tour through industrial Lancashire of Mr. Louis Beale, Commercial Counsellor to Legation in China.

MANCHUOKUO CITIES.—Manchuokuo has announced a plan of city construction for Mukden Province. Six cities, Taoan, Shanhai-kwan, Chinchow, Penchihi, Antung and Yingkow, will be partially rebuilt, and work begins early in 1935. Commencing December 1, work of building Greater Harbin was started at a cost of Y.12,000,000 on a three-year plan.

PLANT FOR FORMOSA.—Japan Industry Co. is said to be behind a plan to set up in Keelung, Formosa, an ammonium sulphate plant with a yearly capacity of 100,000 tons on a capital of Y.10,000,000. The company is being delayed because of an argument as to whether power to be used in running the plant should be natural gas or electricity.

STEEL PIPES IN MANCHUOKUO.—A large steel pipe-manufacturing concern, with a capital of Y.8,000,000, of which Y.2,000,000 will be paid up, is to be organized in Manchuokuo. The name of the firm will be the Manchuria Steel Pipe Manufacturing Company. The shares of the company were to be open in Tokyo for subscription at the end of September.

SOVIET BLOOMING MILL.—On December 25, the third Soviet-made blooming mill was put in operation at the Zlatoust metallurgical plant. The mill differs from the first two blooming mills of Soviet manufacture in that its electrical equipment was also designed and produced in the U.S.S.R. First trials of the mill have proven entirely satisfactory. Its output is set at 250,000 tons of high grade steels annually.

CEMENT ENTERPRISE.—Tokai Portland Cement Company is to be founded shortly at Takahama, in Aichi Prefecture, Japan. Annual production is estimated at 360,000 metric tons. Work on the first part of the plant is expected to be finished in January, 1936, and on the second before the end of that year. The concern is to be capitalized at Y.3,000,000, and is closely connected with the Mikawa Portland Cement Company.

MALACCA RECLAMATION.—Malacca Council has approved the reclamation by the Government of foreshore at the western foot of St. Paul's Hill, forming part of town area, an area of 10 acres, for the purpose of: (a) Utilizing dredgings from the Malacca River; (b) providing site for commercial and Government buildings; (c) providing improved landing facilities and access to the sea front. The process of dredging the Malacca River has been going on for many years.

JAPAN'S MOTOR INDUSTRY.—The Toyoda Automatic Loom Works, Nagoya, intends to produce small passenger motor-cars. The company has purchased a large tract of land covering 700,000 tsubo in a Nagoya suburb, where a 2,000 tsubo factory will be erected. About 2,000 workmen will be employed to produce 300 cars daily. The sum of Y.20,000,000 will be invested in the enterprise. The proposed enterprise means the entry of the Mitsui interests into the automobile business.

SODA PLANTS IN JAPAN.—Toyo Rayon Company, a subsidiary of the Mitsui Bussan Kaisha, has decided to found a soda company with the object of supplying chemicals for rayon yarn manufacture. A factory will be erected at Fushiki, Toyama Prefecture. One of the most significant events of late in rayon circles is plans involving the self-supply of chemicals. The Asahi Bemberg Company is now carrying out a program of self-supply at its Nobeoka plant, the Kanegafuchi Spinning Company is doing the same at its Takasago factory, the Teikoku Rayon Company at its Mihara plant, and the Showa Rayon Company at its Nishiki factory.

TOYKO WATER SUPPLY.—Casting about for an adequate supply of water for Tokyo, the city authorities propose to convert into an enormous reservoir a low-lying section of land two and one-half miles wide and stretching ten miles to the east of the cities of Omiya and Urawa. Tokyo engineers declare it an ideal reservoir site, requiring merely an embankment to hold 2,500,000,000 cubic feet of water. The cost is estimated at Y.500,000,000. Farmers from the area involved have protested, declaring that the rural population must not suffer for the sake of the citizens of Tokyo, and that if Tokyo has insufficient water, part of its industry should be transferred to rural districts.

RECONSTRUCTION OF HARBIN.—Complete reconstruction of Harbin has been confirmed. \$35,000,000 is to be spent in five years. The city is to be divided into four basic districts—commercial, industrial, residential and suburban, including parks, squares, etc. A water and drainage system has been sanctioned. Other points include the transfer to the municipality of the tramways and motor-buses. Remembering the terrible flood of 1932, the whole of the river bank will be reconstructed so as to protect the town from any possible overflow. In Tokyo a loan of Y.20,000,000 with Japanese bankers has been arranged, thus making it possible to commence work at once. The South Manchuria Railway Company intends to construct a new hospital in Harbin at a cost of Y.350,000.

SHIPPING

NEW FERRY FOR YANGTZE.—The Nanking Ministry of Railways is considering building another train ferry steamer for connecting the Tientsin-Pukow and the Shanghai-Nanking Railways. The service rendered by the s.s. *Changkiang*, built in England, has been found most satisfactory, but it is considered advisable to build another ship of the kind in order to meet the increasing volume of traffic. A committee has been formed to study the matter. It is understood that the Ministry has not yet made up its mind whether a ferry steamer like the s.s. *Chang-Kiang* could be built in China.

NEW OIL TANKER.—A new oil tanker was recently completed by the Nikolaev ship-building plant on the Black Sea. The tanker has a capacity of 10,000 tons of oil.

NEW CHINESE PORT.—In connection with the development of a new port for the Chinese State Railways in Honan, the Fraser and Chalmers Engineering Works, Erith, Kent, has just secured an extensive contract for a complete power station, a coal storage, reclaiming and shipping plant, and handling equipment for general merchandise. The power station will house four steam turbo-alternators. The coal-handling plant includes a wagon tippler and some 5,000 feet of belt conveyers capable of handling 400 tons of coal an hour.

The new port is to be called Lian Yuen and will be situated on the River Wang Hoo.

COMMUNICATIONS

MERCURY REFINERY.—The first mercury refining plant in the U.S.S.R., at Nikitovka in the Donetz Basin, will begin production in the near future. When fully completed the plant will be one of the largest in the world.

NEW POWER PLANT.—The Godo Electric Co. has the sanction of the Communications Ministry to erect a steam power station in Yokkaichi with a capacity of 2,700 kw. The concern has also decided to buy 5,000 kw. of power from the Toho Electric Power Co.

IRON FOR JAPAN.—The Joint Pig Iron Marketing Company which successfully concluded a contract with Soviet Russia for the importation of 40,000 tons of Russian pig iron this year is negotiating with Sir Nowroji Bapuji Saklatvala, director of the Tata Iron and Steel Company, for the purchase of 250,000 tons of Indian pig iron for delivery next year. The new consignment would be to cover the increase in consumption of pig iron in Japan. Sir Nowroji Saklatvala is at present on a visit to Japan.

BRIDGES IN MANCHUOKUO.—In accordance with an agreement reached between the Manchuokuo Government and the Korean Government-General the Hsinking Government has decided to launch a seven year program for the construction of eight bridges across rivers on the Korean-Manchuokuo border, according to information reaching here. The bridges will be built at Pitsaotung, Waichatung, Maoerhsan, Changpai, Tucheng, Maoshan, Huining and Heitingtzu. Construction of the Heitingtzu-Keiko bridge will be commenced this year.

AVIATION

JAPAN-SIAM AIR LINE.—Arrangements for a direct air service between Tokyo and Bangkok have been completed, according to a report from a Japanese source in Tokyo. The Japanese Naval Department is to place four planes on this run, and a capital of \$200,000 is required.

CHINA BUYS PLANES.—According to information received from authoritative sources in Shanghai, two hundred aeroplanes have been imported into China from abroad since last August.

Of these 110 were bought in the United States, 40 in France and 50 in Italy. Of those bought in Italy, 20 were bombers, ten combat planes, ten scouting planes, and ten training planes.

The first of three Breguet 27.3 (860 geared and supercharged Hispano 12 Ybros.) biplanes, recently ordered, has been sent to Nanking.